RUN®

The Commodore 64 & VIC-20 Magazine

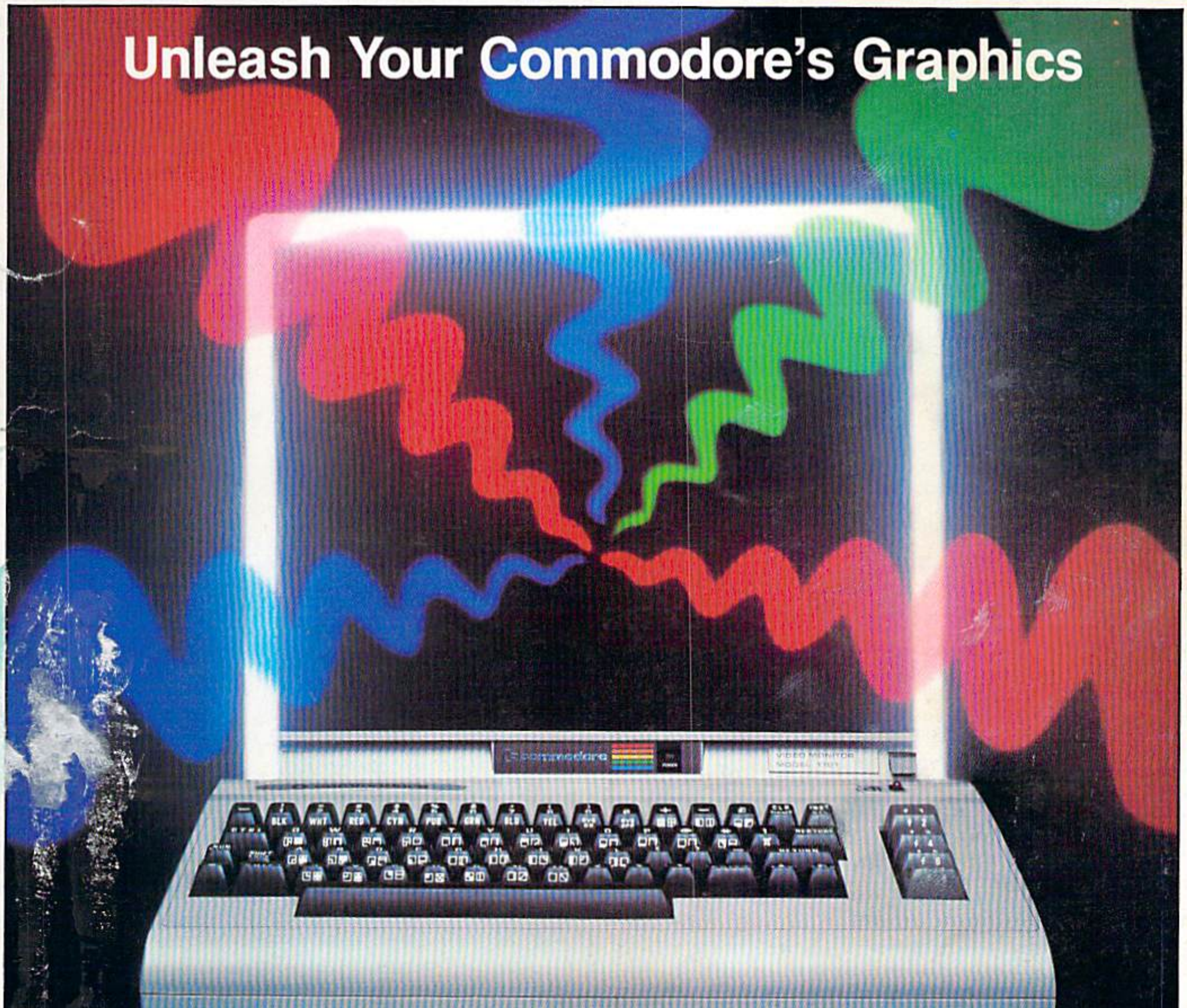
USA $2.95
February 1984
A Wayne Green Publication

Driving Tips For the 1541 User

Mosquito Alert: An Itchy Problem

Draw a Bead on the VIC Shooting Gallery

Finally, Functional Function Keys



Unleash Your Commodore's Graphics

Program of the Month—VIC-20/C-64 Database

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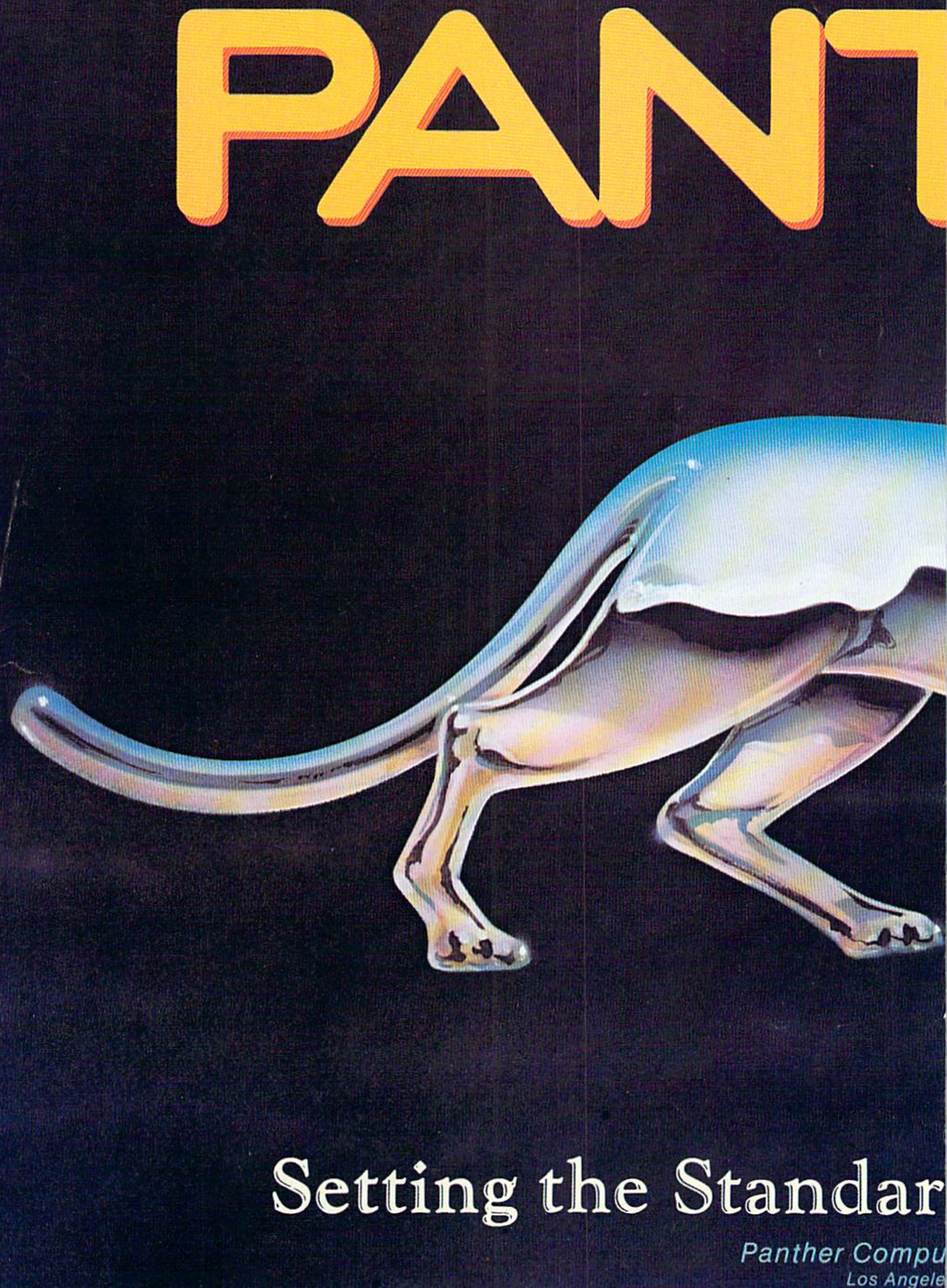
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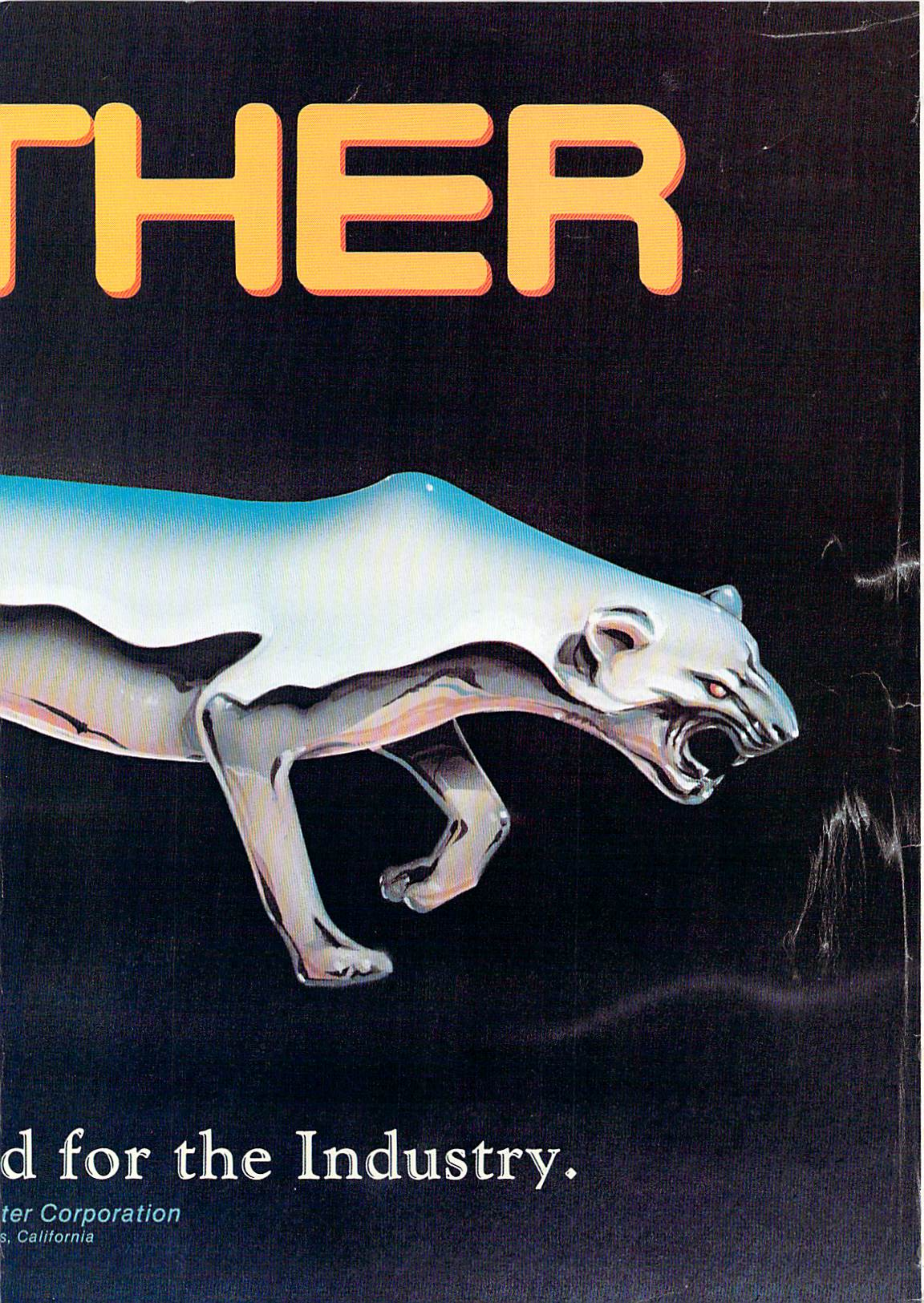
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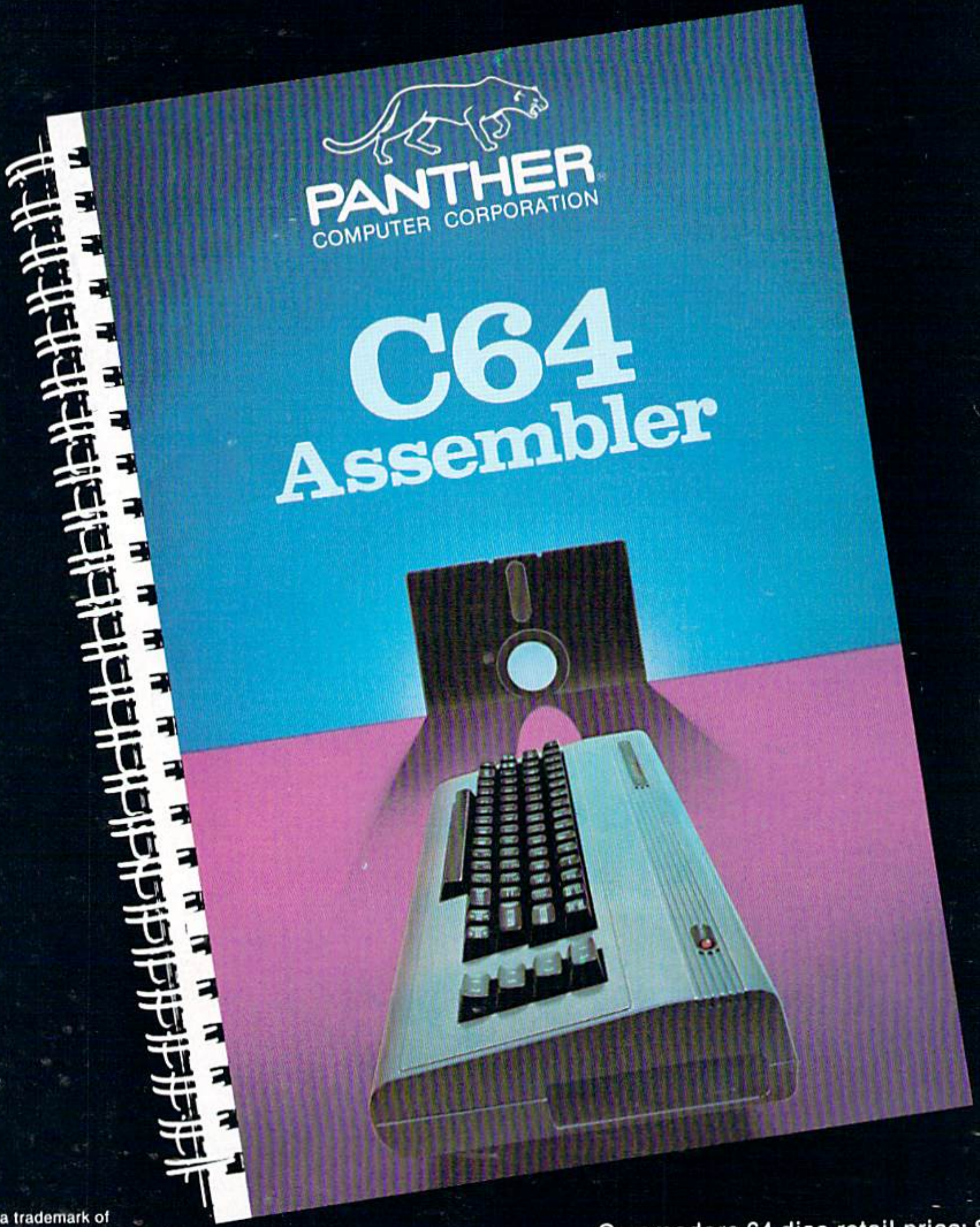
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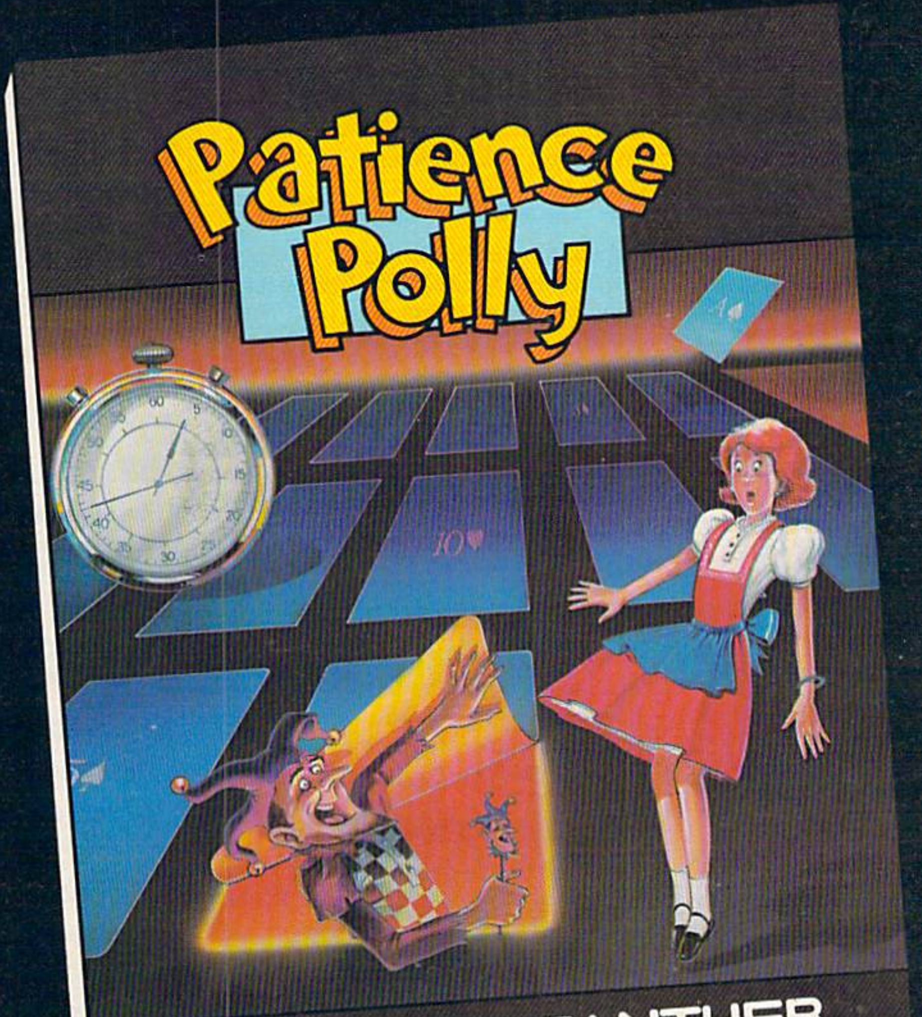
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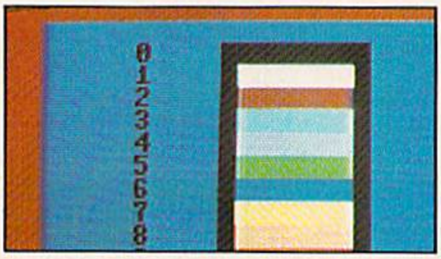

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RUN (0741-4285) is an independent journal not connected with Commodore Business Machines, Inc. *RUN* is published monthly by Wayne Green, Inc., 80 Pine St., Peterborough, NH 03458. U.S. subscription rates $19.97, one year; $29.97, two years; $41.97, three years. Canada and Mexico $22.97, one year, U.S. funds drawn on U.S. bank. Foreign $39.97, one year, U.S. funds drawn on U.S. bank. Foreign air mail subscriptions—please inquire. Second class postage pending at Peterborough, N.H. 03458, and at additional mailing offices. Phone: 603-924-9471. Entire contents copyright 1983 by Wayne Green, Inc. No part of this publication may be reprinted or otherwise reproduced without written permission from the publisher. Postmaster: send form #3579 to *RUN*, Subscription Services, PO Box 954, Farmingdale, NY 11737. Nationally distributed by International Circulation Distributors. *RUN* makes every effort to assure the accuracy of articles, listings and circuits published in the magazine. *RUN* assumes no responsibility for damages due to errors or omissions.

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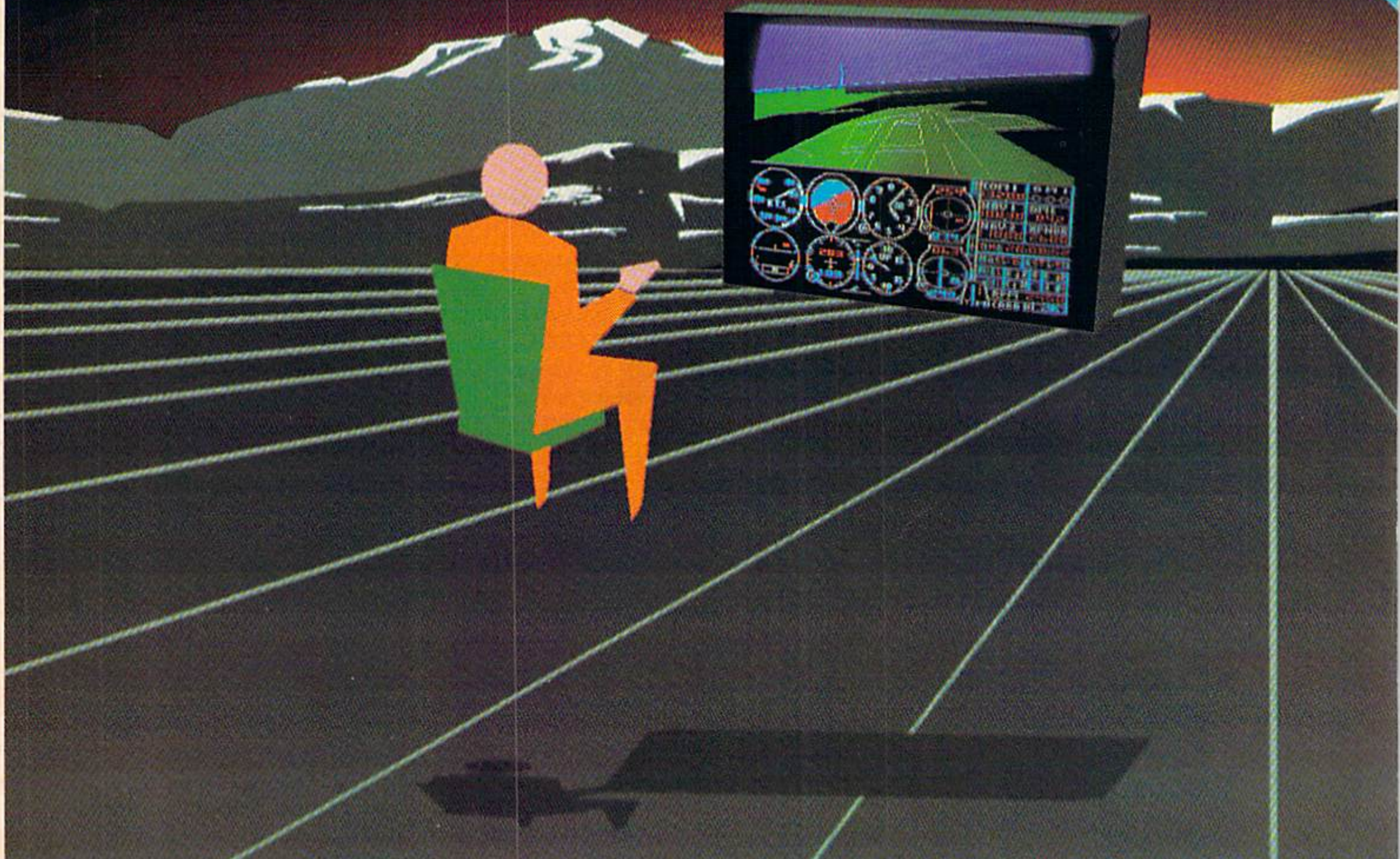

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RUNningRuminations

Making a List, Checking It Twice...

Nobody's Prefect

In response to the premiere issue, readers have inundated us with telephone calls and letters. The nature of many were complimentary; some were critical; but most were suggestive (in the helpful, not the risqué, sense).

And what was the topic most often mentioned? Program listings, of course—the bugaboo of microcomputing publishing.

Keying in programs is a time-consuming task that can be very rewarding or very frustrating. (If you've ever spent several hours in front of your computer typing in a listing only to end up with an "Out of Data," "?Syntax Error," "Undef'd Statement" or other error message, you know what I mean.)

RUN's readers are active computerists looking for good programs to type into their machines and add to their software libraries. They shouldn't have to be concerned about the technical accuracy of the published listings in our magazine. We feel that debugging should be left to the more serious programmer. After all, who wants to spend his time fixing program lines when he could be using the program?

RUN makes every effort to provide easy-to-use listings. Many readers applauded our efforts and found the program listings easy to read.

However, even in the most well-intentioned system, bugs can creep in. When it comes to publishing listings, editors have everything—from ill-humored gremlins to Murphy's law—working against them.

And so it happened in our premiere issue. Some program lines were inadvertently left out of the published listings. The missing lines are printed in this issue (see page 142).

If we err again, we will print the corrections in the following issue. But the trick is to catch the errors *before* they are published.

To put our readers' minds at ease, *RUN* has redoubled its efforts to ensure the accuracy of its published programs.

Program listings are *not* manually typed. That's *really* asking for trouble. Program listings are submitted on tape or disk, which a technical editor then tests and debugs, if necessary. Listings are generated from that tape or disk on a letter-quality printer. In the process, those hard-to-read graphics characters are translated into clear and concise instructions (see "How to type listings").

In this issue, you will notice one improvement to our listings: We have slashed all the zeroes in the listings. We're sure this change will help our readers better distinguish between zero and the letter O when entering listings.

We will continue our method of listing the program with the text, which readers feel is better than flipping back and forth between listing and article.

Readers should be alerted to the fact that *RUN* will be making the programs published in the magazine available on tape and disk. So, if a program looks too intimidating to type in, you may want to wait until it is offered on magnetic media.

We are also considering the use of a checksum reader, as a further check on the accuracy of the listings.

Even with all these safeguards, there still exists the possibility of incorrectly entering a listing. The number one cause of programs not working properly is user error. We will be doing all we can to make sure that our listings are error-free. It's up to you to be careful when entering listings.

We're considering implementing 22-column VIC listings and 40-column C-64 listings to match the computer's screen display. This will aid the reader in the entry and checking of the programs entered from the magazine.

RUN will remain dedicated to providing useful, economical, game and application programs for the VIC-20 and C-64 user. When the need arises, we'll always be flexible enough for change to accommodate the needs of our readers.

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RUN Wants You!

We're not looking for just a few good articles. We're not even looking for a lot of good articles. We are looking for a lot of *great* articles! You have them and we want them! *RUN* magazine is going to be the best magazine ever for the Commodore 64 and VIC-20. We have a little ways to go, and we need your help. Send us that clever programming technique you stumbled upon, that fantastic game you designed, that utility program that is going to revolutionize the way people use their computers.

Write it down! Mail it to us! We pay *real* money for articles *if* they are good enough.

What sort of articles? Any and everything under the Commodore sky.

You and your computer have gone through a lot together, and you must have learned quite a few things along the way. Share that knowledge with the rest of us.

What sort of unique tricks, styles, applications, experiences did you pick up on the way to where you are now? What do you do with your Commodore 64 or VIC-20 that no one else does? What programs have you written that are really marvelous?

Basic programming or programming in Basic, humor or satire, cartoons or games, assembly language or assembling projects, tips, trips, high scores, numbers, user groups, sorts, soups, nuts, facts and even fictions.

We are proud, but we'll read anything in English. If you aren't sure that your idea is the kind of thing that we are looking for, try it anyway! You never know, we may just buy it, and your name will be in lights!...or ink, anyway.

Send your submissions to:

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For a copy of the *RUN* author's guidelines, send us a self-addressed, stamped envelope.

How to type listings from RUN magazine

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from RUN by translating everything we thought might be confusing in any program.

When you see something in brackets, all you have to do is press the keys indicated. For example:

[SHIFT L]—means hold down the shift key and press the L key at the same time.
[COMD J]—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.
[SHIFT CLR]—hold down the shift key and press the CLR/HOME key.
[HOME]—press the CLR/HOME key without shifting.
[CTRL 6]—hold down the control key and press the 6 key.
[FUNCT 2]—function 2 (in this case, you hold down the shift key and press the function 1 key).
[CRSR UP] [CRSR DN] [CRSR LF] [CRSR RT]—these are the four cursor directions.
[UP ARROW]—means the arrow key (the one with the pi sign under it).
[POUND]—the British pound sign (£).
[PI]—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: [22 spaces] or [17 CRSR LFs].

We hope this system will make it easier to enter the listings without having to remember or refer to any charts or conventions. If you have any suggestions as to how we might improve the system to make it even easier, drop us a letter.

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a self-addressed, stamped envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to *RUN* editorial offices. "How to Write for *RUN*" guidelines are available upon request.

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MAGIC is tricks, MAGIC is fun.
MAGIC is doing what cannot be done.

Compiled by Louis F. Sander

Magic

MAGIC is a monthly column of hints, tricks and odds and ends from the worlds of software, hardware and applications.

Every month, MAGIC brings you brief and useful computer tricks from around the world—tricks that others have found to make computing easier, more enjoyable or more exciting.

MAGIC features simple hardware ideas, one-line programs, useful subroutines, little-known computer facts and similar items of interest. We look for new or recycled material that is of current value to Commodore computerists and that can be implemented with a minimum of time, effort, or theoretical knowledge.

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RUN *will pay up to $50 for each unpublished trick we print.*

Note: MAGIC's tricks are numbered in hexadecimal for your edification.

This month we have a series of tricks to use when presenting information on the screen, plus some sorcery for hex/decimal and decimal/hex conversions. As usual, one-line programs and interesting antiquities have also been conjured up for your pleasure.

And remember, you can let your hobby help pay for itself by sending your good ideas to us. We print all sorts of useful information—tell us about your own tricks, and if we use them, we'll send you a check.

$12 Detecting keypresses—When using GET to detect a keypress, the fact that previous keystrokes are saved in the keyboard buffer can be a nuisance. Often, when a game is finished, you will want the player to restart the game by hitting a key. Here is a common way to do it:

```
510 PRINT“PRESS ANY KEY TO RUN”
520 GETA$:IFA$ = “” THEN520
530 RUN
```

Those lines will run the program again even if a key was hit *before* line 510 is executed. You can fix the problem by adding the line 500 FORI = 1TO10:GETA$:NEXT.

You can do the same thing in *one* line by replacing lines 500–530 with this:

```
500 PRINT“PRESS ANY KEY TO RUN”:POKE198,0:WAIT198,
1:RUN
```

“POKE198,0” clears the keyboard buffer. “WAIT198,1” tells the computer to sit there and wait until a key is pressed.

Westmoreland Commodore Newsletter

$13 Quotation marks—When using the Print statement with material enclosed in quotes, it is often acceptable to eliminate the second quotation mark. For example, the computer will treat these two statements just the same:

```
100 PRINT “MAGIC IS FUN”
110 PRINT “MAGIC IS FUN
```

Eliminating the second quotation mark saves a byte of memory, a keystroke and a space on the screen line, which are all important from time to time. But be careful—the last letter of the material in quotes *must* be the last thing in the program line. Because of the GOTO in this statement, the second quote, 120 PRINT “ABRACADABRA”: GOTO 120, must be retained.

Because of the semicolon after this Print statement, you also need the closing quote, 130 PRINT “LEGERDEMAIN”;

L.F.S.

$14 Semicolons—It is often acceptable to eliminate the semicolons between several items that are to be printed on the same line. As long as there is no ambiguity about where one item ends and the next begins, the semicolons are unnecessary. In this example:

```
140 PRINT A$;B$;C$;D;“E”
```

the dollar signs and quote marks make it absolutely clear which item is which.

The line can easily be shortened to:

```
140 PRINT A$B$C$D“E”
```

The semicolon *must* be included in this line:

```
150 PRINT F;G
```

If it were removed, the computer would print the value of variable FG, which is not what is wanted.

L.F.S.

$15 Commas—Putting a comma between two items in a Print statement causes the second item to be printed at the next preset “tab stop” on the screen. On the Commodore 64, there are four tab stops per screen line, while on the VIC-20, there are only two. Additional commas between the items cause additional tab stops to be skipped. If you want A and B to be printed at tab stops 1 and 4, here's a tricky way to do it:

```
100 PRINT A,,B
```

L.F.S.

$16 Screen framing—Here's another “antiquity,” this time from the first issue of an old newsletter called *The PET Paper* (circa 1978). The routine prints a frame around the screen of a Commodore PET, but it works fine for a C-64. If you change a few numbers, it will also work on the VIC-20.

```
3000 REM ** FRAME ROUTINE **
3010 PRINT “[clear]”;:FOR I = 1TO39:PRINT F$;:NEXTI:PRINT
“[cursor up]”
3020 FOR I = 1TO23:PRINT F$TAB(38)F$:NEXTI
3030 FOR I = 1TO39:PRINT F$;:NEXTI:PRINT “[home]”
```

In this routine, F$ can represent any character. You can replace F$ in the routine with your favorite character (enclosed in quotes, of course) or change F$ each time you draw the frame. For example: 40 F$ = “X”:GOSUB 3000.

But remember—if you use this routine as a subroutine, you must add a line 3040 Return, and you need an End statement somewhere above the routine so you don't fall into it as your program executes.

The PET Paper

$17 Programmable Cursor Control—You can position the cursor anywhere on the screen by using a routine like this:

```
10 X$ = “[39 crsr rights]”:Y$ = “[24 crsr downs]
100 X = 20:Y = 10:GOSUB 3000
110 PRINT “SORCERY”
2999 END
3000 REM ** POSITION CURSOR **
3010 PRINT “[home]”LEFT$(X$,X)LEFT$(Y$,Y);:RETURN
```

Variables X$ and Y$ should be set up early in the program and never changed. The code in Line 100 establishes the desired cursor position, then calls the subroutine in 3000, which positions the cursor on column X and line Y. (X = 0 for the leftmost column, Y = 0 for the topmost line.) On return from the subroutine, line 110 prints the desired material at that position. Line 2999 prevents unwanted execution of the subroutine.

The PET Paper, Vol. 1, #1

$18 More programmable cursor control—Once you understand the technique in Trick $17, you can shorten things by eliminating line 10 and changing line 3010 to read:

```
3010 PRINT "[home]"LEFT$("[24 crsr downs]",Y)TAB(X);:RETURN
```

Kathleen Mead

$19 Hexadecimal counting—To learn about the hexadecimal numbering system, it's helpful to count things in hex. That's why we number our tricks hexadecimally. (In case you haven't noticed!) The "pound sign" or "number sign" shows that what follows is a number, while the dollar sign is a widely-used convention to indicate hexadecimal notation. There's also a convention for indicating binary notation—the percent sign—but it's not seen so often.

L.F.S.

$1A One-liner department—The first of two one-liners this month is a hex to decimal converter. It converts a four-digit hex number, expressed as string variable H$, to its decimal equivalent, expressed as numeric variable D. It is as follows:

```
100 D=0:FORI=1TO4:D%=ASC(H$):D%=D%-48+(D%>64)*7:
H$=MID$(H$,2):D=16*D+D%:NEXT
```

To see the routine in action, add these two lines, then run the program:

```
50 INPUT "HEX";H$
150 PRINT D
```

A.W. Grym

$1B Another one-liner—A complementary one-liner is this decimal to hex converter, which converts decimal number D to its four-digit hex equivalent H$:

```
200 H$="":D=D/4096:FORI=1TO4:D%=D:H$=H$+CHR$
(48+D%-(D%>9)*7):D=16*(D-D%):NEXT
```

You can test the converter by adding it, plus 250 PRINT H$ to the program in Trick 1A.

A.W.Grym

$1C Connectors—When you attach external devices to your computer, you need special cables, which you can often make yourself *if* you have the right connectors. This trick identifies the connectors used on Commodore machines and gives specific information on finding them in stores.

The round connectors used for power, video monitor and disk/printer hookups are often called "DIN" connectors, after the German standards organization responsible for their design. DIN connectors are frequently used in audio equipment, especially that made in Europe, so connectors and patch cords can often be found in audio stores.

A good plug for the 5-pin audio/video monitor socket is the Radio Shack #274-003, available in any Radio Shack store. Six- and seven-pin DIN plugs for the disk/printer and power sockets are available at electronics parts stores carrying the Switchcraft PREH line of connectors. The 6-pin is Switchcraft #12BL6M, and the 7-pin is #15GM7M; current prices are in the $2.50 range.

The Control Port, which accepts a joystick or paddle controller, takes a standard female plug known as the DB-9, made by many manufacturers. The Radio Shack #276-1538 will fit this port, and the optional #276-1539 hood will give the connection a nicely finished appearance. Each part costs about $2.

The television connector on the Commodore 64 takes a very common plug known as a phono plug or an RCA plug. A variety of inexpensive phono plugs are stocked at Radio Shack, audio stores and wherever electronic parts are sold.

The Cassette and User Port connectors are called printed circuit board edge connectors. Edge connectors are made in a huge variety of types and grades, so finding the right one is like looking for a needle in a haystack. The ones for your Commodore are standard items for ¹⁄₁₆-inch-thick PC boards, with contacts on .156-inch centers. The User Port takes a 12-position dual-sided connector, while the Cassette connector uses a 6-position single- or dual-sided connector.

Give those specs to your parts man. He can tell you what he has, which might include a variety of types in a price range from $2 to over $10. The cheaper connectors are fine for your purposes, and you'll probably want the kind with solder lugs rather than wire-wrap pins or other special terminals.

A good User Port connector in the $2 price range is the TRW/Cinch #50-24SN-9 or equivalent; a similar connector for the Cassette Port is the TRW/Cinch #50-12SN-9. If possible, also get a polarizing key for each connector. This key is a tiny piece of plastic that slips into the connector and fits into a slot cut in the PC board; it keeps the connector from being inserted upside down.

We couldn't find a source for Expansion Port connectors, which are male PC edge connectors. If you know of a source, tell us about it.

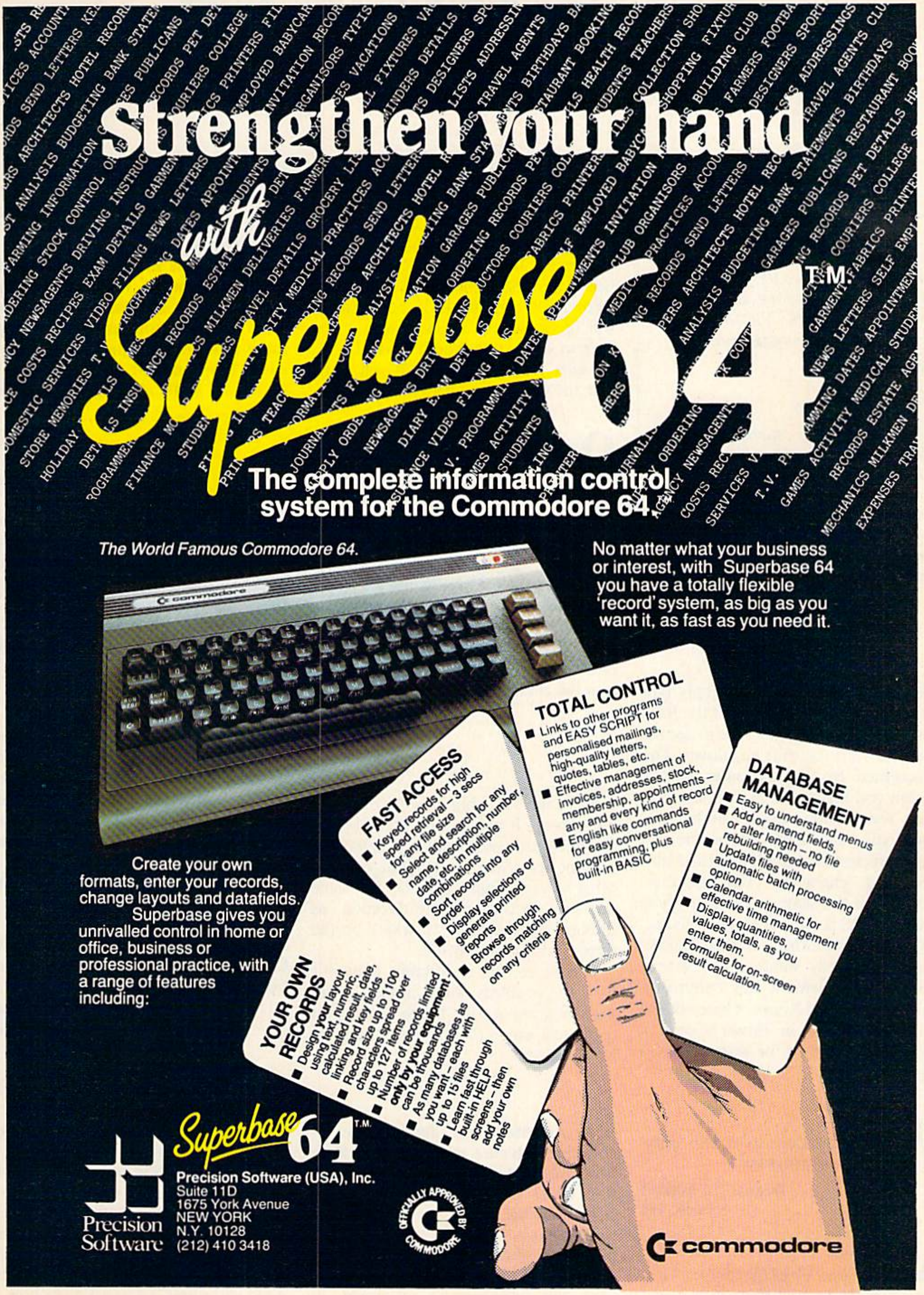
Victor H. Pitre

$1D Color Pokes—It's easy to remember the poke values for the first eight VIC/C-64 colors—the poke is one less than the number on the color's key. BLK is on the 1 key, so its poke is 0; WHT is on the 2 key, so its poke is 1, and so on.

Margaret Ittel

$1E Selecting disks—Commodore disk drives specify the use of soft sectored disks, which are the type with a single index hole punched into the magnetic media. In reality, Commodore drives don't use the disk index hole at all, so they'll work with hard sectored (many-holed) disks as well.

Paul Aitkenhead



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Commodore Clinic

By Jim Strasma

Commodore clinic is a regular monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your new VIC-20 or C-64 computer. Send questions to:*

Jim Strasma
1238 Richland Ave.
Lincoln, IL 62656

(Also include a stamped self-addressed reply envelope if you would like a personal reply.)

Q: What is the Poke for shortened commands (up to eight letters from one key)?

Dennis Hallingstad
Sparta, WI

A: No Poke is needed. Simply type the unshifted first character of the Basic word you want and then type its second character with the shift key down. This is accepted by the computer just as though you had typed the whole word. Since some Basic words can be confused, you may need to type the first two characters unshifted, and then shift the third character. For instance, G(shift)O is the same as GOTO, where as GO(shift)S is the same as GOSUB.

If you need other shortened commands, you may want to buy a programmer's aid with a Key command, such as power and Sysres. These allow a whole phrase (or in Power's case, a whole subroutine) to be activated by a single keystroke.

Q: What is the Poke to list two separate sections of a program?

Dennis Hallingstad
Sparta, WI

A: There is no Poke for this yet. Next best is to: 1) list the first section you want; 2) press the Cursor Down until the first line of the listing is at the top of the screen; 3) Cursor Up to the line just below the first section; and 4) type the second list command. If both listings will fit on screen at once, with a few lines to spare, this should work. If not, consider getting a printer. It will vastly ease the work of studying long listings.

Q: We are developing a light pen for the 64. But it seems that rapid (i.e., more than two per frame) accesses to the VIC-II command and memory control registers cause RAM to be scrambled at random. I suspect that the refresh from the 6567 is disrupted in some way. The only solution we could come up with was to insert delays (at least one frame time) between control register accesses. I would appreciate some insight into this matter.

Michael A. Eskin
San Diego, CA

A: Your VIC chip may be off in its bus timing. It accesses the same bus as the microprocessor, and it is quite important for them to stay out of each other's way. Yours may be the same problem, in the opposite direction, as the one which caused "sparkle" on the screens of many early 64s.

It may be that a different 64 won't have the problem. Also, instead of always waiting a full frame time, you could just watch for a refresh, or possibly force one.

Q: Are there any database or accounting software programs that have been adapted for behavior modification data? I am a psychologist at a state hospital, where we are involved with many behavior modification programs, generating reams of paperwork. We have to keep track of baselines and responses to programs, as well as tokens and commodities in stock or sold.

I would hate to have to reinvent the wheel by starting from scratch. My intention is to do some of the paperwork at home on my C-64, to get more time with my patients. I hate to admit how much of my time has to be spent on staff meetings and paperwork.

Herb Gross
Elgin, IL

A: Professor Ed Crossman will try to help you. He uses PET model computers similar to your C-64 for animal behavior control experiments, and he has published some programs on the subject. His address is: Sof-Touch, 2071 North 1600 East, North Logan, UT 84321.

Q: From what I've read and learned from a dealer, Tally printers are trouble-free and sturdy, and Tally provides maintenance. Can I expect any extra service or help by paying a local dealer $400 more than the same printer would cost via mail order?

Are there that many problems interfacing and operating a C-64 with a non-Commodore printer? And if I have probems, can I get help via the Commodore Information Network on CompuServe?

Trin Wooten
Rossville, GA

A: Tally printers are among the most durable of all, according to a friend who is a Tally repairman. Yes, Tally will repair your unit within a few hours if you're willing to pay the fee, which may even include air fare if you live far enough from a service center. It may well be worth an extra few hundred dollars to go with a local dealer who has used the Tally extensively with the C-64 and knows how to use all its features.

Basic interfacing to the C-64 is simple, via a Card/? or similar serial bus interface. But full control of graphic features is anything but simple on any printer. If graphics are very important to you, take another look at Epson's FX-80 or C. Itoh's Prowriter. Both are already supported by current models of the Card/? interface. As for the Network, don't expect Commodore to be very interested in helping you hook up a non-Commodore printer using a non-Commodore interface, no matter how you contact them.

Q:How can I hook a 4040 disk drive up to my 64?

Steve Shubitz
Resida, CA

A: There are two major ways companies have connected the 64 to work with the 4040 disk and other IEEE-488 devices. One type consists only of the Interpod, ($180 from Oxford Computer Systems). It plugs into the serial bus, just like the 1541 disk, and takes no memory space at all.

The other type is typified by the C64-Link ($140 from Computer Marketing Services) and by the Bus Card ($200 from Batteries Included). These plug into the cartridge port and must occupy some memory space, even though they are usually able to stay out of the way of other programs. (Commodore's own $60 IEEE-488 cartridge may also soon be available.)

In general, the Interpod will work with more programs more easily than the C64-Link. However, it is 4 times slower than the C64-Link. Therefore, I use one of each, connected simultaneously. The Bus Card is more difficult to connect than the C64-Link, but works with more programs without effort.

One other hint: when using a dual disk with a 64, leave a junk disk in drive number one when it is not in use. Several 64 programs try to initialize that drive, and halt if it doesn't contain a usable disk.

Q: My PET Emulator always crashes on a public domain games disk. Why?

Connie Archambault
Meriden, CT

A: Many games are written in machine language to speed up the action, and the Emulator only fixes Basic programs. Don't expect it to work with programs that include the command SYS or USR ( ). There is also a problem using the Commodore public domain disks on some C-64s. This is reportedly remedied by a small program available from many user groups.

Q: Can I use Cardco's Printer Utility Package to print Commodore graphics on the Mannesmann Tally MT180-L printer? Its ad claimed "Epson code response."

Trin Wooten
Rossville, GA

A: Sorry, the Tally isn't listed as compatible in Cardco's literature. However, if it truly accepts Epson's Graftrax commands, it might work anyway. Check with Tally (Kent, WA) and Cardco (Wichita, KS) to be sure.

Q: How do I anticipate printer incompatibility problems with wordprocessor or spreadsheet software? Also, should I run a serial or a parallel printer on my 64? Why?

Kenneth Benson
Columbia, SC

A: The surest way to avoid compatibility problems is to buy the software first, and buy the printer recommended by the creators of the program. Next best is to buy a Commodore printer because nearly everything for the VIC or 64 supports them, among others.

If you will be buying the printer first, try to interface it via the serial bus, so it will look as much like a Commodore printer to the computer as possible. Also, look for programs that allow you as many choices of printers as possible. For example, Paperclip (from Batteries Included) goes out of its way to work with almost any printer.

As for the type of connection, parallel printers can be a bit faster than serial printers and cost a bit less, but they are also harder to connect to the computer from more than a few feet away.

Clouding the issue is the fact that the VIC and 64 don't support either one without added hardware or software. This currently tilts the balance in favor of parallel printers, which (surprising though it seems) are usually interfaced to the serial bus via smart interfaces, such as Cardco's Card/?. Serial printers are usually connected via the User Port. That port works well too, but it is rarely supported by commercial software.

Q: I can't find continuous form-feed envelopes narrow enough to fit in my Epson FX-80 printer. Its maximum is ten inches, and the narrowest carrier is 10 ⅝ inches. I can do labels, but that doesn't look professional. Any suggestions?

Connie Archambault
Meriden, CT

A: Press-on mail labels may not look professional, but neither will dot-matrix printing on envelopes. A quick worker can apply labels almost as fast as the Epson prints them.

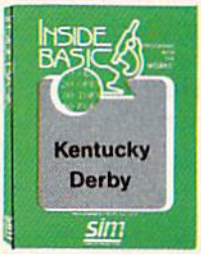
You could ask your dealer about trading in the FX-80 on the newly announced FX-100, which has a wider carriage. If looking professional is worth at least $3000 to you, trade up to a daisywheel printer with an envelope feeder.

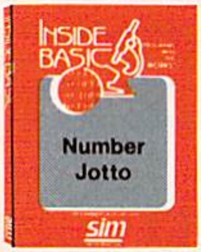
Q: Is it possible for relative files to co-exist peacefully with other DOS files—that is, without writing over them? Also, I am stuck at opening a relative file with a VIC or 64. Any suggestions?

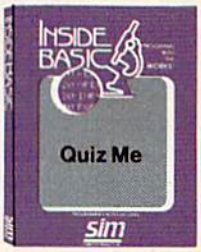
Bob Sullivan
Oak Park, IL

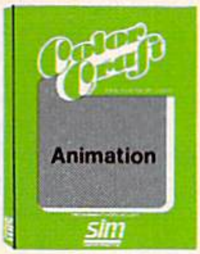
A: Yes, that is one advantage of relative files over direct-access files. A direct-access file may not respect existing files. Relative files give equally flexible access to any record within a file, but keep themselves separate from all other files properly allocated in the BAM. Relative files also appear properly in the disk directory, and are compatible with DOS's Validate command.

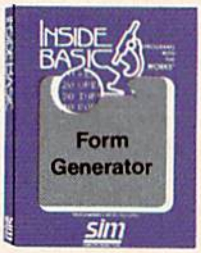
Here is a short routine to create a relative file from a VIC or 64. NAME is the name of the file, RL is the desired record length, from 2-254, and NR is the maximum number of records anticipated. (NR times RL must total a few blocks less than the remaining space on the disk.) Device 8 and drive 0 are also assumed.

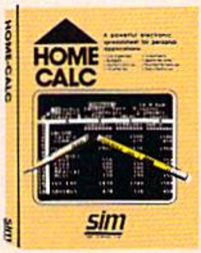












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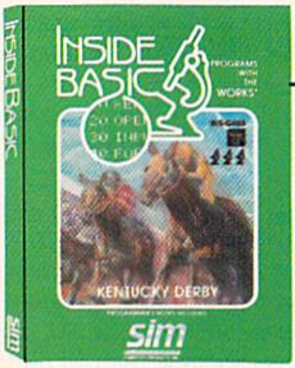
†Programmer's notes available free with response card and include program overview, line by line description, complete listing, variable chart, and suggested changes.

Entertainment



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Commodore 64/VIC 20+8K
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Commodore 64/VIC 20+8K
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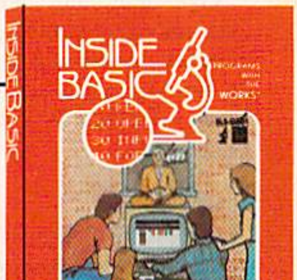

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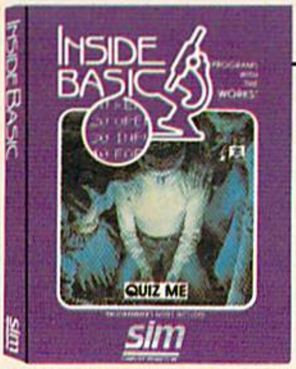
Education



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QUIZ ME is designed to allow multiple choice, fill in the blanks, and for those questions where spelling is not important, approximate answers. You can specify the number of tries per problem. There are advanced features that allow you to specify the time you have to answer and the number of points awarded for each problem. Upon completion of the quiz, automatic scoring, percentage scaling, and letter grading give the student his complete results.

QUIZ ME gives continuous reinforcement and encourages you to try harder and learn more. QUIZ ME is an exceptional program for parents and teachers who wish to make learning more enjoyable.

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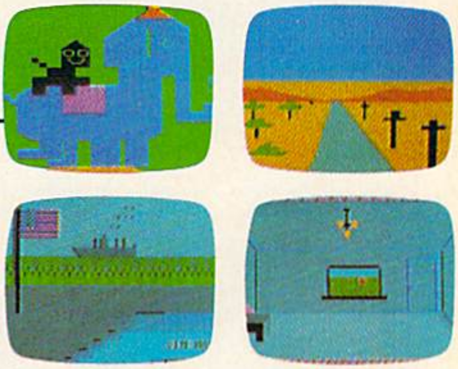
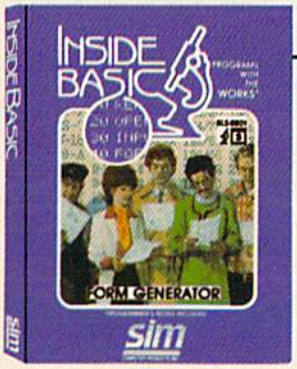


Commodore 64/VIC 20–memory expansion not required
(suggested retail: $24.95)*

Business/Home



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Requirements: Commodore 1525, 1526 or compatible printer.
16K memory expander recommended on the VIC 20.

Commodore 64/VIC 20+8K
(suggested retail: $29.95)*

Features: labels and formulas: add, subtract, multiply, divide
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default input values
fixed decimal number formatting
repeat sequences (a must for invoicing)
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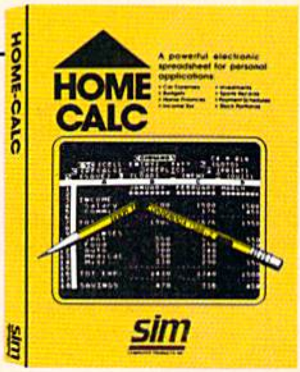
Features: sum, replicate, recalculate
title and formula capability
add, subtract, multiply, and divide
selectable column width and number formats
machine language speed

Requirements: Commodore 1525, 1526 or compatible printer

Commodore 64
(suggested retail: $24.95)*



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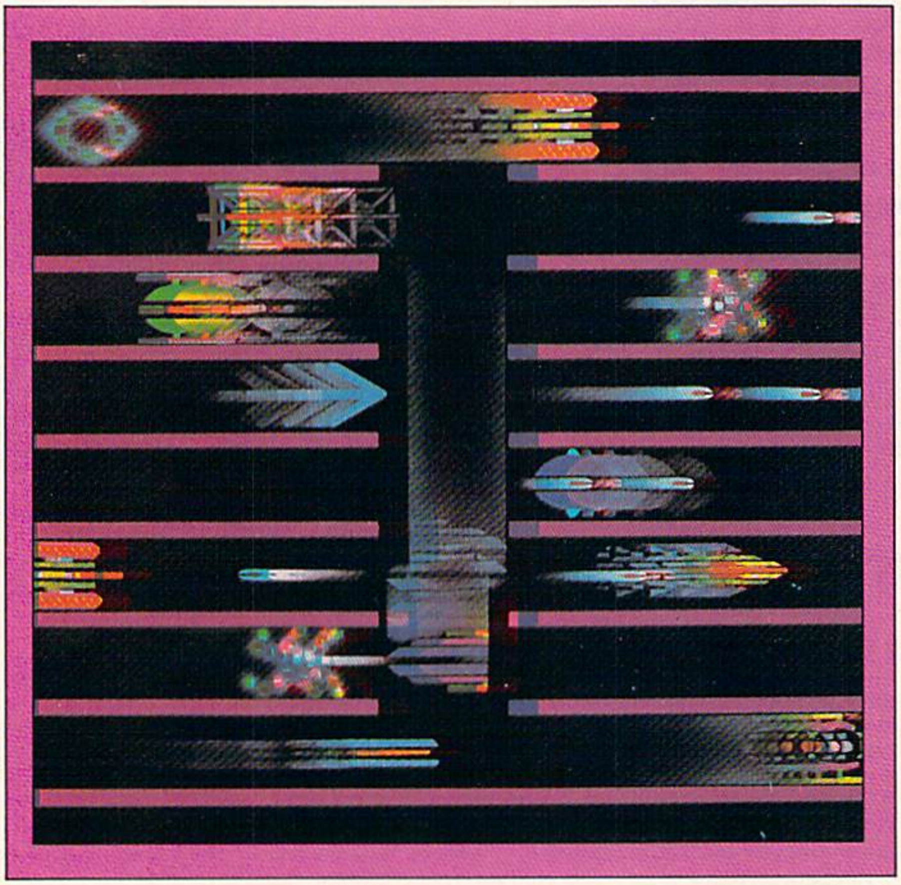
Software Gallery

Compiled by Shawn Laflamme



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A—Superb!
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C—Good.
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D—Mediocre.
There are some problems with this program. There are better on the market.

E—Poor.
Substandard, with many problems. Should be deep-sixed!

Turmoil

This Fast-Paced Shoot-'Em-Up Leaves No Room for Indecision. Hesitate, and You're a Goner!

B

Savvy marketers are no longer putting all their software eggs in one basket. They are now selling the really good games in versions for every major computer system. So Turmoil (Sirius Software Inc., 10364 Rockingham Drive, Sacramento, CA 95827. $34.95), which has been around a long time for some other systems, has finally been converted for the VIC-20 and Commodore 64. I tested the C-64 version, which is provided on a 1541-format, 5¼-inch floppy disk.

Turmoil divides the screen into nine horizontal corridors, something like a musical staff, except that a center column is provided for your ship to roam up and down. Pressing the joystick in a northerly or southerly direction will move the ship to the top or bottom of the screen. East-west movement will reverse direction, Defender-style, enabling you to shoot down any corridor you choose.

Movement up and down, facing first one way and then the other while firing, can be fast and furious. Your challenge is to shoot various objects that travel from one side of the screen to the other through the corridors.

Most succumb to a well-placed bullet. Some, like the ghost ship, you cannot kill at all. You can slow the robot tank by forward fire, but not destroy it; only attack from the rear will score a point.

Pulsating Prizes

Periodically, a "prize" will appear at the far end of a corridor. When that happens, you can move down the hall and capture the pulsating prize. This is the only time during the game when horizontal movement is permitted.

You must gain the prize quickly, however, because after a few seconds it turns into a bouncing missile that is one of the most deadly objects in the game. Moreover, once the prize has been secured, a ghost ship appears in the corridor almost immediately. Grab your points; then get out!

Nine levels of difficulty are provided. At higher levels, the invaders come faster and more frequently, making both dodging and shooting them more challenging. Excellent sound effects tip

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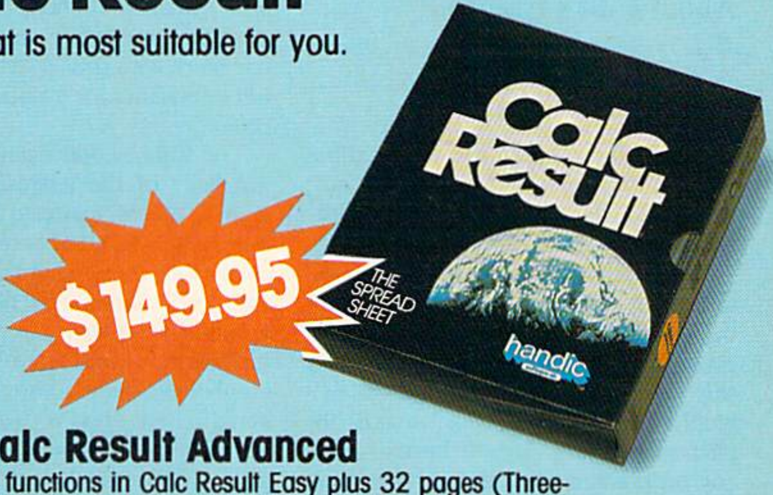

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Turtle is a language unto itself, designed for children and other computer beginners.

you off as to which enemy is approaching, and the graphics are nothing short of top-notch.

Even novice players will be able to enjoy Turmoil. Four ships are provided to make play last a reasonable time at beginner levels. If you're an experienced player, there's no need to go through unchallenging lower levels to get to the fast action. Just press the F5 function key until you reach the desired difficulty level—and then play.

David Busch
Kent, OH

Turtle Graphics II

Attention, Beginners! Let the Turtle Teach You About C-64's Graphics

C

The first thing to note about Turtle Graphics II is what it is *not*: it is not an enhanced Commodore language.

Turtle is a language unto itself, designed for children and other computer beginners; if you already do a lot of programming and just want an easier way to access the Commodore 64's graphics capabilities, this is not the package for you. If you haven't done any programming, or if you wish to become familiar with Turtle language, then this is a good way to get started.

The first good thing about Turtle Graphics II is its cartridge form—instant-on always beats loading!

The second good thing is the Turtle language itself. In Turtle, you guide an imaginary turtle (here, represented by an asterisk) around the screen with such commands as Forward, Right, Rotate, Turn Around—practically English! When you program Pen Down, the turtle will leave a trail of whatever character you have specified, or print the text you have written. Since most commands can be executed in either lo-res or hi-res, you can draw character-size thick or pixel-thin lines.

There are sprite-specific commands that make the design and movement of the sprites simple. Collisions between sprites can be detected, as can sprite-background collisions. Their movements are simplified by the use of such commands as Set (heading), Speed and Wrap Around.

The programming principles of loops, if-thens, etc., are included in the Turtle language—after all, it was invented to teach children programming concepts. Loops are set by a Loop X command; conditions can be tested by If False Jump and If True Jump commands.

The Jump command specifies a subroutine by name, rather than line number. A Turtle subroutine to draw a box can be preceded by a Label Box command, and ended with a Routine End statement. Then, Jump Box will execute the "box" subroutine. After you work with this aspect of Turtle, you will be wishing for a similar capability in Basic.

You will be continually amazed at the simplicity of the language in this program. You can generate a tone with the Beep command, set Screen and Border colors with those commands—even Text and Print commands need no quotes around the strings.

Program lines are automatically numbered, then automatically renumbered if you choose to insert or delete any. The programming is done from a main menu, which is a drawback. To change a line, for instance, you have to choose the List option, specify which lines you wish to see, go back to the main menu, choose the Replace option, then specify which line should be replaced.... The absence of on-screen editing can get annoying after a while.

Another drawback of the program is its slowness. Each line takes about four seconds to be entered into memory; because of the keyboard buffer, you can keep typing, but you risk the chance of losing a few letters if you're very speedy. Program execution is also relatively slow, a disappointment if you have programmed a very intricate design, which can take a full five minutes to complete.

The documentation is excellent, with two exceptions.

First, you are not warned that failing to leave a space between a command and its argument means the number will be lost, but you'll find out soon enough.

Second, the manual lists Gray 1, 2 and 3 as acceptable color commands, but, after receiving repeated error reports, I finally realized that the correct command is Grey! The manufacturer is aware of this latter problem, and is, presumably, taking steps to correct future editions.

The minor annoyances of working with Turtle Graphics II are balanced by the thoughtful extras included. All commands have easily remembered two-letter abbreviations that you can use, and your listing will include the long form of your command.

It deserves reiteration that Turtle Graphics II is not for the adept programmer who wants an easier way to get at Commodore graphics; it is meant for beginners, and it is well-designed for that group. *(Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005. $59.95.)*

Sharon Aker
Sussex, NJ

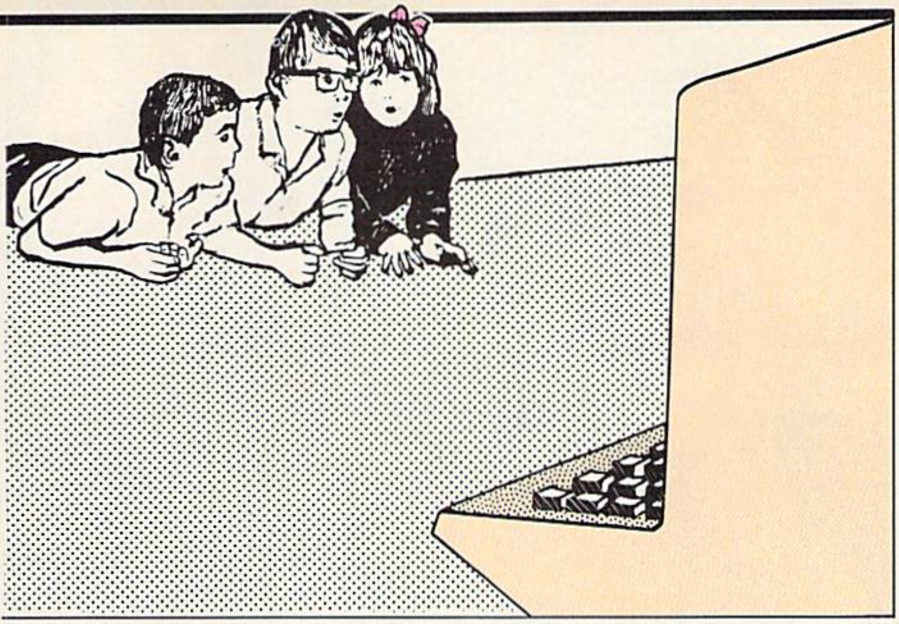
Logo

Logo is *the* Word When It Comes to Learning and Computers

B

For the educator and the programmer, and especially for anyone with a Commodore 64 and a limitless imagination, Commodore Logo (Commodore Business Machines, Inc., 1200 Wilson Drive, West Chester, PA 19380. $99) is finally here.

Logo may be new for microcomputers, but its use with mainframes goes back more than 15 years to its development at a high-tech firm in Boston and its application in research laboratories.



Logo is a practical educational tool of unlimited potential.

The efforts of people like Seymour Papert of MIT's Logo group brought Logo to the world of microcomputers. Through their work, Logo became a practical and promising educational tool with almost unlimited potential. For those of you who are interested, Papert also wrote an informative introduction to Logo's history called *Mindstorms* (Basic Books, 1980).

Basically, Commodore Logo is a language that gives you direct control over a sequence of events through simple user-friendly commands that take full advantage of the C-64's capabilities.

Commodore Logo features primitives (Logo defined commands) and procedures (user defined commands) throughout the development of any Logo routine. Using the Graphics mode, you control a "turtle" (an external robot), directing it to draw in the color, direction and frequency you desire.

With Computation, you can integrate the simple operations of addition, subtraction, multiplication and division into your routines. It also offers such operations as generating random numbers and setting variables (such as pi) to fixed values.

Both Graphics and Computation are very useful modes, but Logo begins to set itself apart from other languages with features such as Words And Lists, which gives you the capability to design programs that let you interactively work with the computer. Using this mode, you can do things such as design your own video games or build sophisticated quiz programs.

It's interesting that Commodore Logo itself (as do Logo versions for other computers) offers Sprites; the combination of the C-64's capabilities plus Logo's features makes this one of the most attractive features of the Commodore Logo package.

You "talk" to each sprite (using a command called Tell), indicating what they should do. You can move them and change their colors. Best of all, you can use one of the four sets of built-in shapes on the utility disk to create your own animated sequences. For example, you can load the "animals shapes file" and access a dinosaur, dolphin or butterfly sprite, all of which are quite good hi-res productions. You can then proceed to use other Logo features to further enhance your creation.

With the Music function of Commodore Logo, you can design sound effects taking advantage of the C-64's extensive music capabilities.

I found the Commodore version of Logo highly satisfactory and easy to use. When our family sat down and experimented, we were amazed at how the use of a simple procedure such as Repeat allowed us to design and then save some fantastic visual images.

However, if you do not have a good monitor, you are likely to be a bit disappointed in the jagged nature of some diagonal lines. In addition, some lines don't really stand out by themselves because they are so thin that the background color "washes" them out. Using the command Doublecolor expands the width of the line and makes it easier to distinguish between the different colors.

Besides four sets of "built-in sprites," the utilities disk also offers a set of demonstration programs (including an adventure game), a text editing file, an example of how to create music (Twinkle, Twinkle...) and at least 20 other files that can help you become familiar with Logo's capabilities. There is also an instant version of Logo that allows the non-reader to use turtle graphics, although in a somewhat limited way.

Commodore's version of Logo is a very powerful tool that can be applied in a variety of settings to fit a variety of needs. The poor and inaccurate documentation that has characterized past Commodore products is not present here. The tutorial that accompanies the program and utility disks is clearly written, but obviously designed for adults. It is a bit cumbersome to use since it is bound as a small paperback. Why couldn't it be spiral bound so that it could lay flat on your desk?

Finally, there must be some reason why the page numbering system in the tutorial uses the first letter of the section (such as G-5 for the fifth page of graphics), but the sections are not in alphabetical order. This can be very confusing!

In ten years, computers will be so friendly that we'll probably be able to communicate directly with them at the machine level. This version of Logo completes a step along that way. For $99, it gives you an efficient, imaginative and well-documented programming language.

Neil Salkind
Lawrence, KS

Vanilla Pilot

Despite the Plain Name, This Program Will Spice Up Your C-64 Capabilities

B

The moment I started writing programs on my Commodore 64, I realized there were things the machine couldn't do. For example, if I wanted to

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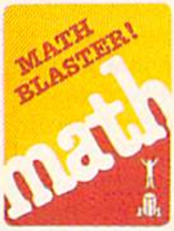

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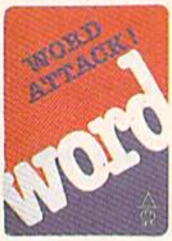

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delete more than one line from the program, I would need to type each line number and hit the return key. Or, if I wanted to add a new set of lines, I would often have to renumber all the lines in the program.

Well, folks, for those of you who find these and other limitations a nuisance, fear no more. Programming languages such as Vanilla Pilot (Tamarack Software, Darby, MT 59829. $29.95) are now available. After some time using the program, I found this to be a helpful, well-designed set of routines and tools for those of us who want to go beyond what the C-64's hardwiring can offer.

This type of programming language software is best described as a set of commands and/or routines that supplements your computer's existing capabilities and greatly facilitates entry and debugging. It complements what your computer can already do. In most cases, it can make you a better programmer by saving you time, as well as allowing you to understand and use more difficult programming concepts.

Vanilla Pilot is such a program, and clearly does what this kind of software should. The software, together with the manual, provides the equivalent of an introductory course in "basic" Pilot language. In addition, it has a brief introduction to turtle graphics, a system for designing graphics images based on the work of the Logo group at the Massachusetts Institute of Technology.

What It Can Do

One of the very useful features is the Auto command. When you begin writing a program, you simply enter Auto and the number you want to represent the spacing between program statements. From that point on, Vanilla Pilot will automatically increment to the next line number after you finish a line and hit the return key. This is a luxury, especially in programs with data and program statements in the thousands, where misnumbering often causes problems that are difficult to detect.

Another very nice feature is the Renumber command. Imagine you have written a program and need to insert more lines than there is currently room for. Typing Renumber automatically renumbers all of the lines beginning with the number 100, and counts by tens for as many lines as there are in the program. This is a convenient and needed timesaver, especially in a long program.

Perhaps the best feature of Vanilla Pilot is the Trace command, which actually allows you to follow the execution of each statement in your program. Using this command, you can trace the sequence of statements in a program to find out where you have gone wrong in your programming logic (if at all) or in your sequence of operations.

The turtle graphics is an introduction to the capabilities of the more sophisticated Logo programs. With this function, you can use the Graphics command to draw and save complicated figures; you can also change the colors of the background, foreground and characters. It gives the new programmer important experience in transforming written statements into visual images.

The documentation is very well-organized, clearly written and highly suitable for even the beginner. It contains several examples, plus full screen illustrations of what your screen should look like.

The shortcomings of Vanilla Pilot are for the most part minor. I give the authors credit for having quiz questions at the end of each chapter, but some of the questions seem a bit silly, and there are no answers provided for you. Also, some commands, such as Directory, are not any more efficient to enter (and sometimes less so) than the normal Commodore key/zero/return sequence. It confuses me as to why the normal Print command can be abbreviated as a simple "t" (probably for type), yet to delete a line, you must enter the entire word "delete."

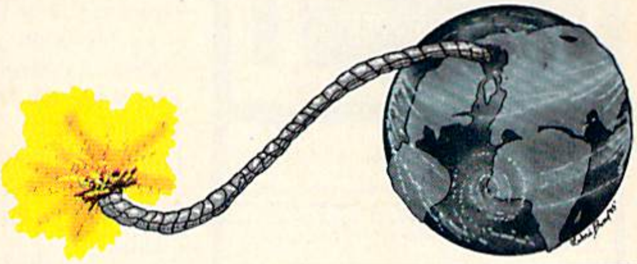
In short, there seems to be some inconsistency in the format of the various commands. However, since it's what the command can *do* that is important, this is a minor problem that could be easily corrected in future versions of the program.

Finally, even though the manual offers an appendix with a summary of commands, I would like to see a one-page summary of programming commands that is easily accessible, perhaps printed on the back cover. (One of my wishes is for all documentation to be spiral bound, so it will lay flat when opened!)

Save for one or two confusing statements, Vanilla Pilot is a good software tool with excellent "hands on" documentation. At $29.95, it is an extraordinary bargain and offers a solid, non-intimidating introduction to programming the Commodore 64 using some high-level commands.

Now then, who would like to guess how it got its name?

Neil Salkind
Lawrence, KS



Nukewar

The Fate of the World Is in Your Hands— Don't Blow It!

I'm sitting in front of my TV monitor. The screen is full of planes, missiles and submarines—my country's contribution to the nuclear arms race. I reach out and push a button to order the building of a new missile base.

Suddenly, the screen turns yellow, the TV emits a series of beeps, and the message "HOT WAR" flashes. What's happening? Did I push the wrong button?

Then it hits me! The enemy's computer has declared war. ICBMs strike home and glowing mushroom clouds blot out my bases. I launch my surviving missiles, send up fighters and order three missile subs to sea.

The next thing I know, my enemy, the Premier, is on the Hot Line. He wants to negotiate. Hmmm, my first strike must have hurt him worse than I thought. I say, "Sorry, I gave at the office," and hang up.

My second wave of missiles reaches their targets. A Trident sub launches its complement, and the last enemy military target vanishes. Mercifully, my cities have remained untouched.

The phone rings. "Please, please, please," he begs, "it was all a mistake. That goofy computer got carried away!"

"Oh all right," I compassionately reply. "Just surrender everything and I'll call off the nukes."

The screen turns a cool blue as the final situation is displayed. All the surviving cities are shown. It seems that world opinion is on my side and since not one of my towns has been touched, I'm declared the winner.

So goes a sample run of Nukewar (Avalon Hill Games, 4517 Hartford Road, Baltimore, MD 21214. $16), a human vs computer nuclear strategy game.

The movie "Wargames" captured the imagination of a lot of us. Could I beat the Whopper computer? Does stockpiling nuclear weaponry increase protection, or is the temptation to use those weapons irresistible? Like the movie, Nukewar raises some serious issues. At the same time there is an undeniable fact: Nukewar is fun.

How to Start a War

When you boot up Nukewar, you're asked to name your country. Then you can name the computer's country. Ever wondered if Toledo could beat up Chicago? Try it and find out.

The game's action randomly starts somewhere between 1956 and 1968. Nukewar uses an 8 × 8 grid to represent each country. The Commodore's excellent graphics abilities are used to depict bases and cities. Your eight cities and first two bases are scattered across the screen. There is, however, a problem: the enemy's grid is blank. Where are his cities, bombers and missiles?

To find out, you'll have to choose between three options for each year/turn. First, you could proceed "normally" and build two bases (bombers, ICBM, sub or ABM). This option will allow you to expand your arsenal quickly, but your neglected spies won't tell you much about the enemy.

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Your heavy commitment to snooping will reveal enemy targets. Instead of looking at a blank enemy grid, you'll see his bases and cities pop onto the screen. Unfortunately, you can build only one base when spying.

Your third choice is to "push the button." Of course, your generals might disobey the order and refuse to launch a first strike. Then you really have problems.

Meanwhile, the computer is building, spying and becoming increasingly paranoid. Who will attack first? I've played the game many times, but only once did I make it to 1983.

No Room for Error

Nukewar is a good game, but it has some problems. It is simple to learn, fun to the point of being addictive, and it has good graphics and sound effects. Nukewar will provide many hours of enjoyment.

However, Nukewar does not handle errors well. Input is checked for proper format but not for length. This means that you can completely ruin the grid display by using country names of more than 12 characters or by adding spaces to your input commands.

I let friends try this game unsupervised, and they proceeded to make these mistakes. When I came back, the grid was hopelessly confused. The new, updated display had been printed beneath the old information it was meant to overwrite, leaving old and new slopped together. If this happens, you might as well start over.

Nukewar also allows the enemy to start a nuclear war much too soon. It gets frustrating to begin a game only to have it end on the second turn.

While this makes each game different and keeps you from getting too relaxed, it's an example of taking a good idea too far. I waited two minutes for the game to load from cassette; I want to play for more than 20 seconds.

There is very good news in the midst of troubles, though. Nukewar is not write-protected. You can load and list like any of your own programs. You can also modify any of the lines to strengthen the game.

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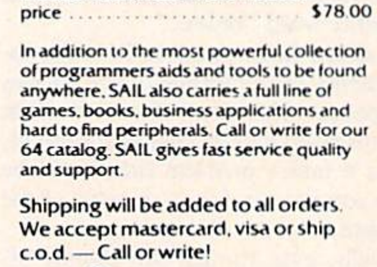

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Now when my friends play the game, they can't enter country names longer than 12 characters. Nor can they ruin the display with extra spaces. I've also changed the error messages to provide clearer guidance. I sincerely hope that Avalon Hill doesn't mind my meddling, but Nukewar works better this way.

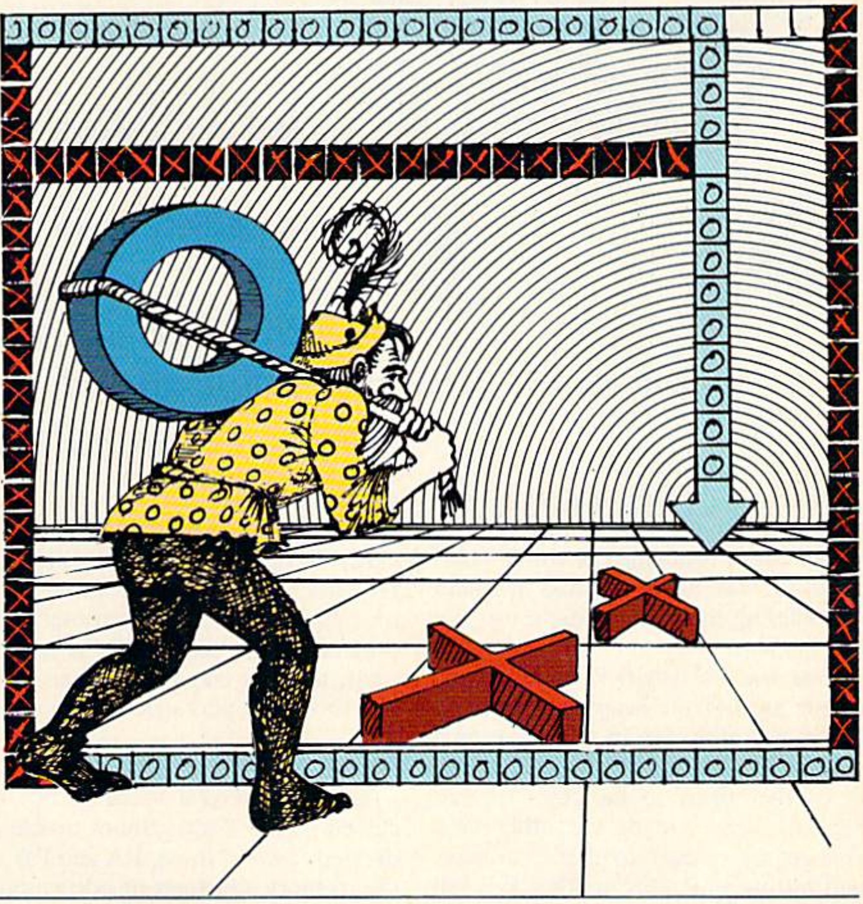
With these comments in mind, Nukewar is a fun, absorbing game with good action. For you Basic programmers, here's a chance to find out how a game works. Don't let this game slip by you—have a good time with it, and learn how to write and modify programs.

Michael Cherry
Park Ridge, IL

Get Four

It's Easy to Play Tic-Tac-Toe, But with 64 Squares, Can You Get *Four* in a Row?

You'll need plenty of logic, planning and intuition to beat your computer.



Imagine playing tic-tac-toe on a special "board" of 64 "squares," and you have Get Four in a nutshell.

Just feed your cassette into the unexpanded VIC-20.

Your object: to get four Xs in a row. The computer's goal is to get four Os. The first to form a straight line across, up and down, or diagonally, wins. You can play this game against either the computer or a human opponent.

Xs and Os can block each other's progression, as in regular tic-tac-toe. There is one twist: during a turn, you must place your X in the *lowest* empty slot in the column selected on your keyboard (columns are numbered one through eight). Your opponent chooses a position for the Os in the same way. Lined up in each column are eight crosses, or placement areas. If Xs or Os already occupy a column, new Xs or Os plugged into that column appear in the next-highest position. No entry to a column completely filled is permitted.

There are four difficulty levels. On the first level, your computer practically rolls over and plays dead. You can beat it in your sleep. At level four, a battle of wits takes place—if you allow the computer to go first, you will be lucky to pull off a draw.

On levels two through four, if the computer goes first, it always puts O at the bottom of column four. That must be a strategic location—like the middle spot for X in regular tic-tac-toe.

I have noticed that the program did not seem to vary any of its responses to identical patterns of moves made against it. In other words, it did not alter tactics to complicate the routine. Perhaps any change in counter-strategy would have lowered its best chance for victory. The implication is that you can "figure out" the style of play with time. But most games that are played over and over again pale in this manner. (This happens in many shoot-'em-ups, for instance.)

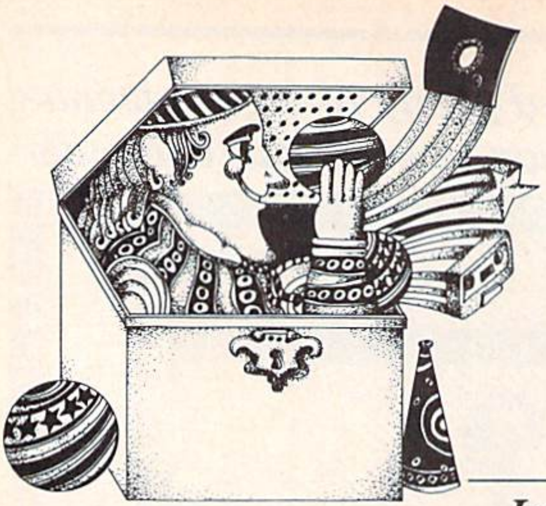
I found Get Four easy and fun. It's also difficult to master—a real plus! The brief directions were a bit vague on one point. The package states that it is a "vertical" game of tic-tac-toe. One phrase tells the player to get "four in a row." Until the game is actually played, however, you mistakenly assume that "four in a row" signifies *vertical* rows, but in fact, it also includes horizontal and diagonal rows. Small matter, but....

The graphics stand out clear and bright. The color scheme is slightly odd, perhaps—but OK. (A red rectangle is bordered by a green frame; white crosses and columns occupy the screen's center.) A question mark materializes and wanders over possible choice-sites, showing the computer's decision-making process. It doesn't take long to make up its mind.

Players' scores are posted atop the screen, on either side of the level-of-difficulty rating. At the end of its turn, the computer signals, "I chose (number of column). Your move?" The info is helpful and time-saving.

Get Four is an interesting strategy game, similar to Connect Four and related versions of tic-tac-toe. Plenty of logic, planning and intuition is involved. I found it to be addicting and fun. Recommended! *(Victory Software Corporation, 7 Valley Brook Road, Paoli, PA 19301. $14.95.)*

John DiPrete
Cranston, RI



Video Casino

By David D. Busch

In this VIC-20 program, your cursor's a chameleon, changing color and character with a keystroke, while you happily draw with the joystick.

Draw is a program that allows you to "draw" on the screen of the VIC-20 in full color, changing the cursor character to various letters and graphics and altering the color at the press of a key or two.

You use the joystick to move the cursor around the screen. The cursor begins as a plus sign in red. Pressing a number key from 1–8 changes the color of the cursor to the color of that key. Pressing one of the other keys changes the cursor to that character, and hitting shift plus another key will invoke the character on the right side of the keyfront.

What if you want nothing printed, that is, blanks in a certain section? Quite simple. Press the 2 key to change the cursor to white. It will still flash green as it moves, so you can see where it is, but the character left behind will be white, and hence invisible against the white background of the VIC-20 screen.

Most of the initialization routines are similar to those in an earlier program, Target Shoot. (See *RUN*, January 1984.) To account for the mysterious moving memory of the VIC-20 in various expansion configurations, we store the actual screen memory and color memory locations in CHAR and CSCREEN, calculate the difference, DF, and set up variable E as the end of the screen for our purposes. The original cursor color, CO, is set to 2 (red), and the cursor character, CURSR, to 91, the plus sign.

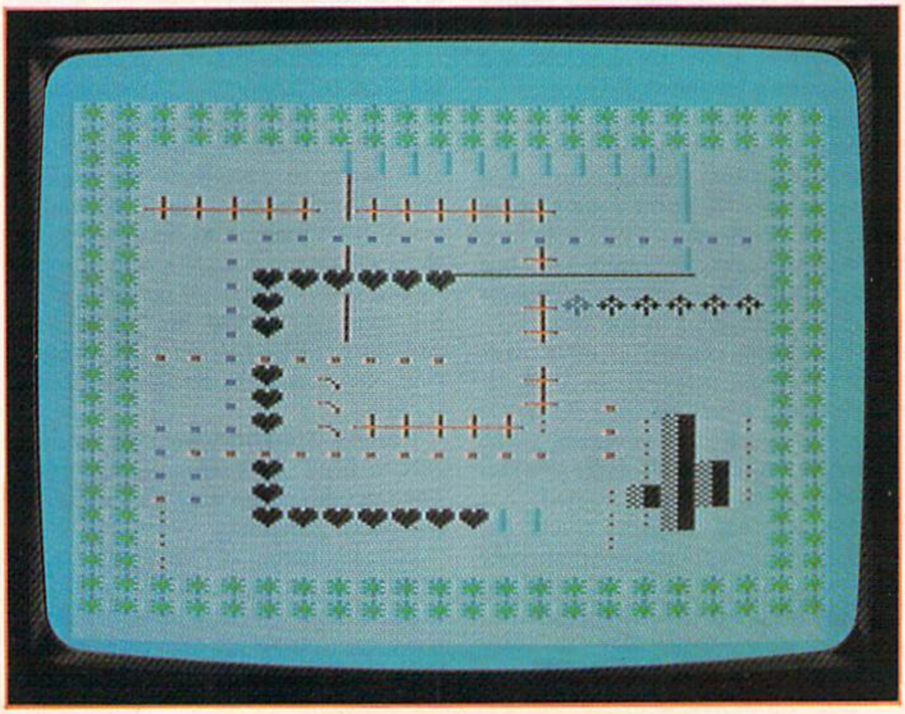
Added Variables

However, several variables not discussed in the Target Shoot article are defined. Two of these, PA and PB, are the memory addresses of ports used to read the joystick switches. The third, DD, is the address of what is called a data direction register (DDR).

The joysticks used in the VIC-20 have five switches. One each at North, South, East and West, plus a fifth, the "fire" button. The status of these switches are read through two ports, with different bits used for different switches. Each bit can be used only for input or output at one time, so you must tell the VIC-20 which it is you want to do.

One port is not used for anything else during the game, so it can be set for input by a simple Poke to its data direction register at 37139. This is accomplished in line 260.

However, the other DDR is used also for keyboard input/output. If it were set for input only, it would be impossible to use the keyboard for other



RUN It Right

VIC-20
Joystick

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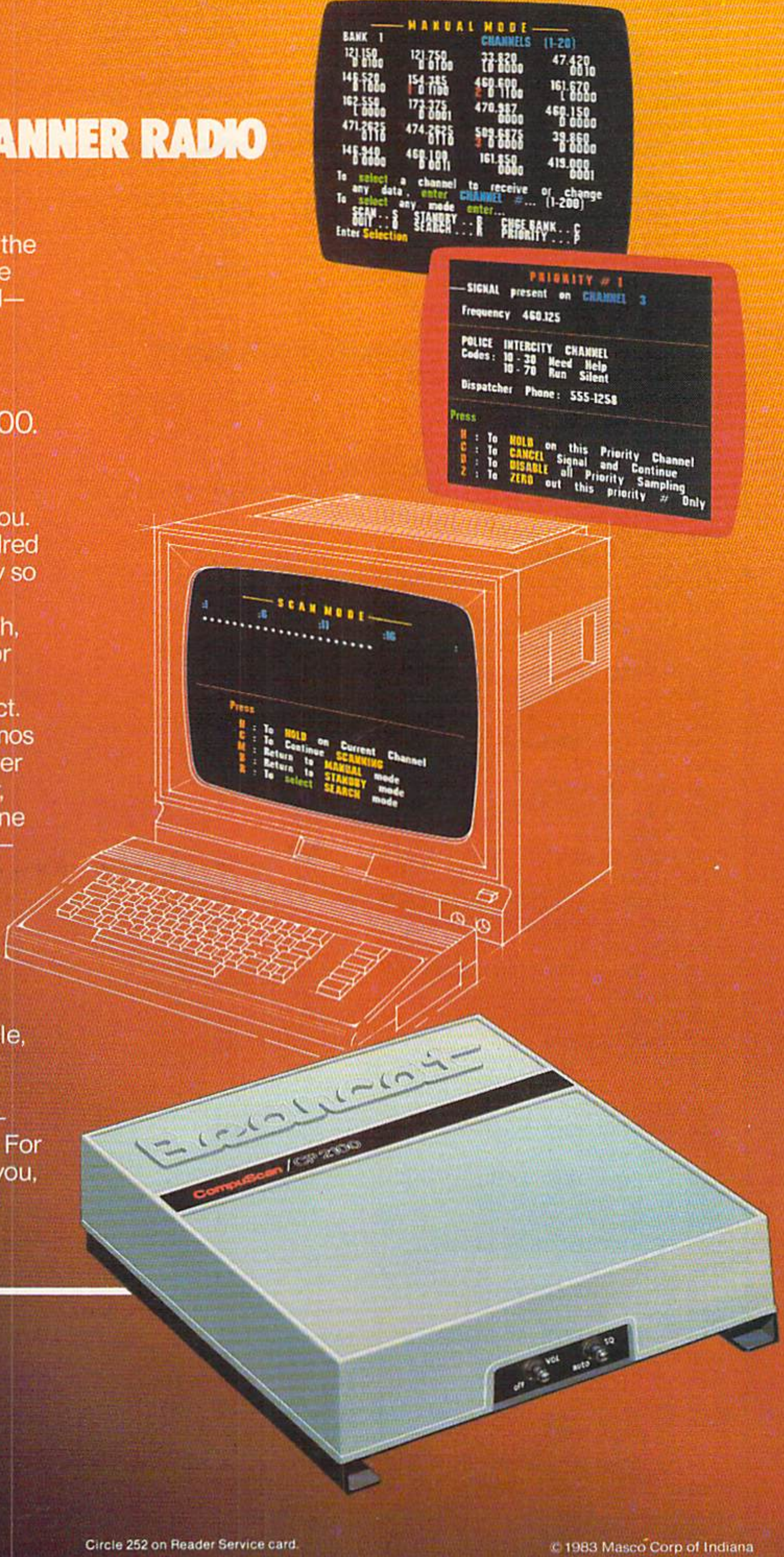

```
——MANUAL MODE——
BANK 1                    CHANNELS (1-20)
121.150     121.750     33.820      47.420
  0 0100      0 0100    L0 0000       0010
146.520     154.785     460.600     161.670
  0 1000    1 0 1100    2 0 1100    L 0000
162.550     173.375     470.987     460.150
  L 0000      0 0001      0000      0 0000
471.2625    474.2625    509.6875    39.860
    0110        0110    3 0 0000    0 0000
146.940     460.100     161.850     419.000
  0 0000      0 0011      0000        0001
To select a channel to receive or change
   any data, enter CHANNEL #... (1-200)
To select any mode enter...
   SCAN..S    STANDBY..B    CHGE BANK..C
   QUIT..Q    SEARCH...R    PRIORITY...P
Enter Selection
```

```
PRIORITY # 1
—SIGNAL present on CHANNEL 3
Frequency 460.125

POLICE INTERCITY CHANNEL
Codes: 10 - 30 Need Help
       10 - 70 Run Silent
Dispatcher Phone: 555-1258

Press
 H : To HOLD on this Priority Channel
 C : To CANCEL Signal and Continue
 D : To DISABLE all Priority Sampling
 Z : To ZERO out this priority # Only
```

```
——SCAN MODE——
:1
       :6
              :11
                     :16
•••••••••••••••••••••
                              :

Press
 H : To HOLD on Current Channel
 C : To Continue SCANNING
 M : Return to MANUAL mode
 B : Return to STANDBY mode
 R : To select SEARCH mode
```

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```
1 REM VIC-20 VERSION
10 REM ********
20 REM *      *
30 REM * DRAW *
40 REM *      *
50 REM ********
60 PRINT"[CLR] [DN] [DN]"
70 PRINTTAB(9)"[CTRL9] [CTRL3]DRAW[CTRL0] [CTRL7] [DN] [DN]"
80 PRINTTAB(1)"USE JOYSTICK TO DRAW"
90 PRINTTAB(1)"HIT NUMBER KEY TO"
100 PRINTTAB(1)"CHANGE CURSOR COLOR."
110 PRINTTAB(1)"HIT OTHER KEYS TO"
120 PRINTTAB(1)"CHANGE CURSOR SHAPE."
130 PRINTTAB(1)"PRESS FIRE BUTTON TO"
140 PRINTTAB(1)"START OVER."
150 PRINT"[DN] [DN]"
160 PRINTTAB(6)"[CTRL9] [CTRL6]HIT ANY KEY[CTRL7]"
170 GET A$:IF A$="" GOTO 170
180 CURSR=91
190 CO=2
200 PRINT"[CLR]"
210 CSCREEN=37888+4*(PEEK(36866)AND128)
220 CHAR=4*(PEEK(36866)AND128)+64*(PEEK(36869)AND120)
230 E=CHAR+484
240 B1=CHAR
250 DF=CSCREEN-CHAR
260 DD=37154:PA=37137:PB=37152:POKE 37139,0
270 GOTO 350
280 REM READ JOYSTICKS
290 POKEDD,127:S3=-((PEEK(PB)AND128)=0):POKEDD,255
300 P=PEEK(PA):FR=-((PAND32)=0)
310 SO=((PAND4)=0)
320 S2=((PAND16)=0)
330 S1=-((PAND8)=0)
340 RETURN
350 POKE B1,CURSR
360 POKE B1+DF,3
370 GOSUB 650
380 POKE B1+DF,CO
390 GOSUB 290
400 CT=PEEK(197):IF CT=64 GOTO 470
410 GET A$:IF A$="" GOTO 470
420 RE=ASC(A$)
430 IF RE>56 OR RE<49 GOTO 460
440 CO=RE-1
450 GOTO 470
460 CURSR=ASC(A$)
470 IF S3<>1 GOTO 520
480 IF S3<>1 GOTO 520
490 B1=B1+1
500 IF B1>E THEN B1=E
510 GOTO 350
520 IF FR=1 THEN PRINT"[CLR]"
530 IF S2<>-1 GOTO 570
540 B1=B1-1
550 IF B1<CHAR THEN B1=CHAR
560 GOTO 350
570 IF SO<>-1 GOTO 610
580 B1=B1-22
590 IF B1<B THEN B1=B1+22
600 GOTO 350
610 IF S1<>1 GOTO 350
620 B1=B1+22
630 IF B1>E THEN B1=B1-22
640 GOTO 350
650 POKE 36878,15
660 POKE 36874,255
670 POKE 36874,0
680 RETURN
```

Listing 1. Draw program for the VIC-20. Next month, we will publish the C-64 version.

tasks during the program. So we define that DDR as DD, Poke it for input prior to each joystick reading, and then return it to normal immediately thereafter.

Unlike most other Peeking, when you look at a single memory location for a given number, in this case the individual bits within a byte are significant. It is possible to find out the status of a given bit by using the AND operator. ANDing a number with an appropriate power of two will tell us how that bit is set.

Joystick reading is taken care of in lines 290 to 340. First, the finicky DDR is set for input by Poking DD with 127. Then, switch three is read by Peeking port PB, and ANDing that value with 128. Finally, DD is returned to normal by Poking it with 255.

The other four switches are read by Peeking port PA, storing that value in P, and then ANDing P with 4, 8, 16 and 32. These produce the status of switch 0, switch 1, switch 2 and the fire button, respectively. All this can be done many times each second, to provide the program with a constant update on the status of the joystick.

Screen Drawing

Drawing on the screen is accomplished by Poking the number corresponding to the cursor character to the memory location stored in variable B1, and the color desired to B1 + DF. B1 is changed each time, depending on the direction the joysticks are pressed.

Just as in Target Shoot, B1 may be incremented or decremented by one by pressing the joystick right or left. However, upward motion is also possible. To move up, B1 is decremented by 22, or a whole line. To move down, B1 is increased by 22. In any case, the program will not allow B1 to exceed E (the end of the screen), or to become less than B (the beginning of the screen memory).

Even while constantly checking the joysticks for movement, the computer also looks to see if any other key has been pressed. The VIC-20 knows if any key at all is being held down by Peeking location 197. If the value in 197 equals 64, then no key is being pressed. Otherwise, the program gets A$. If A$ is a number key, the program changes the color of CO. If it is not, the cursor becomes the character A$.

The only other input the program responds to is the fire button. If it has been pressed, then the screen is cleared, and you may begin drawing anew. Ⓡ

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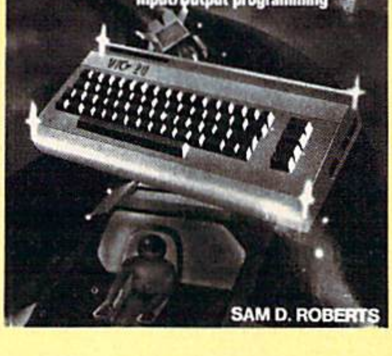

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The Mail RUN

Welcome Words

I just received my first issue of *RUN* and am delighted with the content. The articles are diversified and interesting to both the novice and the "hacker."

Of the many new magazines entering the market for the Commodore 64 and VIC-20 computers, *RUN* is a welcome addition.

Richard Tsukiji
Roseburg, OR

Is 20 ≧ 64?

I just received the *RUN* announcement in the mail and immediately subscribed by phone. As a C-64 owner, I find there is an absolute dearth of material on the 64 and tons of material on the VIC-20. I hope you will try to fill the gap and provide the thousands of 64 owners some sorely needed material on the 64.

Also, give us a few games, but don't fill the magazine with them as so many others have done.

I'd like to see some articles on interfacing the popular printers with the 64, character generation, printing the PET graphic characters on non-Commodore printers and articles of that sort.

Wishing you every success.

Manuel Botelho
Ft. Washington, MD

I am interested in your magazine if it will help me with my VIC-20. It seems that everything in your brochure is in regards to the Commodore 64.

Catherine Bobcock
St. Petersburg, FL

I haven't received my first copy of *RUN*, but I am partly "turned off" by your letter and brochure—95% of the material was addressed to the C-64 user.

In my area, there must be at least 50 VIC-20s on the air in 2 meter, 6 meter and low level amateur radio usage. *RUN* needs to address amateur radio uses, as well as games, business and educational uses.

Just had to put this to you before you get too far off the beaten path. Best of luck.

Tom Schropp, WA4QNY
Palm Harbor, FL

We appreciate your input. Will we favor the C-64 and sweep the VIC-20 under our carpet? No! We plan on maintaining about a 50–50 ratio between the two machines.

And all you Hams out there...bear with us, 'cause we have several articles in the works...just for you.

Editors

The Answer Is Here

I can't wait to see your article on defining function keys. I asked Commodore what the function keys were used for, and they only told me they were used in special programs, so I was still at a loss.

Also, I tried trick number $00 in the Magic column, and it works! I am looking forward to the February issue and am recommending *RUN* to other VIC-20 owners.

Denny Jakoubek
Garner, IO

As the proud owner for the past several months of a Commodore 64, I am looking forward to receiving my first issue of *RUN*.

Since you seem to have all the answers, or know where to get them, can you please tell me how to use the function keys?

I have both the "User's Manual" and the "Programmer's Reference Guide," and although the "User's Manual" shows a nice picture of the function keys and states how one can save time by programming them to do repetitive tasks, neither book tells *how* to program these keys.

I would be eternally grateful if you could provide me with this information. Thank you.

Anthony S. Pisarri, P.E.
Peekskill, NY

Turn to page 70 of this issue.

Editors

A Real Treat

Your first issue arrived. It will be hard surviving until January for the February issue, but I'll dig in. Excellent.

I appreciate the business reply card you provide to help me get more information from advertisers; I made use of it already.

Your magazine came in, day before Thanksgiving, and it is something to be thankful for.

Bob Mueller
Minneapolis, MN

Color for Kids

Thank you for sending me information on *RUN*. I would most like to see some listed programs in your magazine for preschoolers. Many such programs make use of the Commodore's graphics and color modes.

Pat Colburn
Eau Claire, WI

Take a *RUN* to School

I run a small home school with six students in grades six through 11. We have a VIC-20 and a C-64.

I hope *RUN* gives me some programming tips that will help improve the quality of my own numerous educational programs that I've written to strengthen my kids' vocabulary and English.

Also, your word processing article will be much appreciated by me, as I have a small freebie that takes much time and lacks most features. I hope your article gives me the needed direction.

Fred Jensen, Headmaster
Grants Pass, OR

Coming Attractions

Send me the first issue of *RUN* and I will distribute it among the VIC group. I hope you are planning ahead to include all programs in your magazine on disk.

Richard Rossignol
Lynchburg, VA

We are planning to make the programs published in this magazine available on both disk and cassette. This will assure that the programs load and run properly.

Editors

I have read several reviews of word processing software for the C-64. Nowhere do I recall seeing a comparable article for the VIC-20.

As a VIC-20 owner, I think it deserves similar mention. Some VIC-20 owners may not realize that it might not cost them very much to expand their VIC system into a word processor system.

Ed Heinen
Bison, KS

I just finished going through your first issue, and really enjoyed reading a computer magazine exclusively for Commodore computers.

Will you do an article for the VIC-20 similar to the one you did for the C-64 on word processors? I have been working, without much success, on assembling the same sort of information presented in your article so that I could decide what program to buy for my VIC.

I would also like to see a comparison of lower-cost printers. I know that this sort of thing has appeared in other magazines, but I never see a comparison of what the print actually looks like. Are all 5 × 7 dot matrix characters the same for all printers that use that means of printing?

Paula Trumble
Denver, CO

Major pieces on these two topics are in the works. VIC-20 word processors in June and printers in December.

All 5 × 7 dot matrix characters are not the same for all printers. There are many different pin and pressure configurations available. Thanks for your interest.

Editors

RUN for Your Life

RUN is one magazine I'll subscribe to as long as I live and use Commodore equipment—if future issues are as helpful and interesting as this premiere issue.

I particularly congratulate you for not using those hard to read and to count graphics characters in your program listings.

Marge Paulie
Eugene, OR

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Graphics Galore For Your C-64

By Gary D. McClellan

Graphics. For many of us this magic word is perhaps the primary reason for being a C-64 owner. You can produce professional, arcade-quality graphics on the machine, but learning to use its full graphics capabilities can be a time-consuming and frustrating endeavor.

This need not be the case, since there are many software tools available to help you obtain quality results. This review will discuss some of the current offerings available to help you enjoy the graphics possibilities of the C-64.

Here are reviews of some programs that will let you take full advantage of your Commodore's spectacular graphics capabilities.

Sprite Graphics

If you like to create sprite graphics to use in games or to liven up text-oriented screen displays, you have probably realized that fast animation sequences are possible by using numerous sprite images like the single frames of movie cartoons. The only problem is building enough sprite images for a full stop action sequence.

Designing sprites on graph paper and then converting the designs to values for storage in memory would take many, many hours. Sprite-building programs are available, however. (One version comes with the software starter disk from Commodore, and other versions have been published in magazines.)

Sprite-building programs are an aid to the rapid creation of sprite images, but a lot of trial and error experimentation still has to be done to find out if the sprites work in an animation sequence. I found I was spending more time writing test programs for various sprite-animation sequences than in working on the game programs I had in mind.

Spritemaster 64

Fortunately, I discovered Spritemaster 64 (Access Software, 925 East 900 South, Salt Lake City, UT 84105; $34.95), a software package that features sprite generation, editing and animation support. It's designed for programmers or for other users who simply want to create computer graphics for their own enjoyment.

The package is more than just a utility program. It is a complete tutorial in understanding sprite graphics and in creating sprites and sprite animation techniques. The program is available for both tape and disk.

An excellent 25-page user's manual fully explains program operation and provides step-by-step instructions for creating a sprite animation sequence. Each step is clearly described and is accompanied by easy-to-understand instructions. By following the examples in the tutorial, I was easily able to animate my own sprite sequence and learn the program functions and commands without confusion.

Spritemaster 64 makes it easy to work with sprites. The program supports a sprite-building function that allows you to create up to 16 different sprite images and store them in the program work area by number. You can store any number of sprites separately on disk or tape for further use. The Build function (using either keyboard or joystick) allows you to draw either single-color or multi-color sprites on a background grid.

Once created, a sprite is kept in the storage area for further use. You can then reproduce its image in other storage areas by using the program's Copy command. After several copies are in storage, you can modify each copy into different "frames" of an animation sequence and then transfer them to a Basic program as data statements, using Spritemaster 64's Transfer command. This Transfer command saves you from having to type in sprite data by hand.

Easy Animation

The commands described so far are those usually found in most sprite utilities. The special power of Spritemaster 64 lies in its viewing and animation functions.

The Animate command allows you to simulate motion by entering the sequence of sprites (frames) to be displayed. The animation sequence can be stepped through one frame at a time or displayed automatically. While the sequence is running, you can speed up or slow down the time delay between frames, and you can move the animated image on the screen left, right, up or down.

The View command is used to display up to three different sprites on the screen at the same time. Once the program is in view mode, you can change various sprite parameters to see exactly how the sprites will look in various positions, colors and sizes. The View command feature I like best is Sprite Move, which enables you to position the three sprites anywhere on the screen.

The Sprite Move feature is an absolute requirement if you like to build images that I refer to as "compound sprites" (larger images, composed of two or more sprites displayed horizontally or vertically together). The Sprite Move command lets you see exactly how a compound sprite will look, so you can easily modify the elements of the larger image to achieve the desired result.

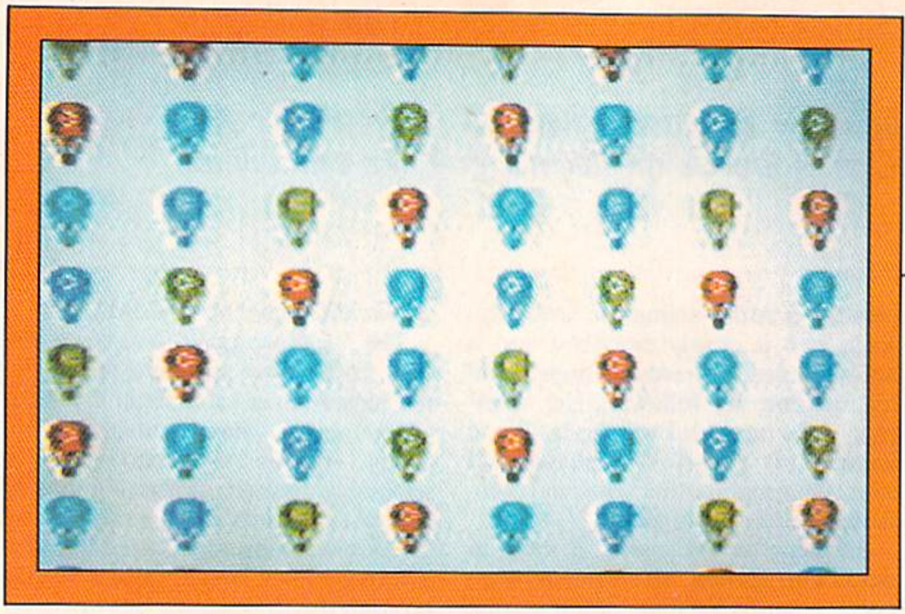
Thanks to Spritemaster 64, I no longer have to spend time writing test programs to find out if sprite images are going to work together in a display. I highly recommend this package to anyone who needs to develop sprites for programs, or who would like to experience the fun of animated graphics on the C-64.

Sprite-64

If you like working with sprites, then you may have reacted as I did at discovering that eight sprites is the maximum you normally can enable at one time on the Commodore 64. You also may have noticed, while reading the C-64 *Programmer's Reference Manual*, that you can display *more* than eight sprites on the screen at one time by using "raster interrupt" techniques.

At this point, you probably did one of three things—sat down and wrote a raster interrupt handler routine, de-

Address author correspondence to Gary D. McClellan, PO Box 346, Rimrock, AZ 86335.



Your dream of 64 sprites on the screen can become a reality.

cided to wait for a rainy day to investigate raster interrupts, or proclaimed loudly, "Raster who?" If either of the last two descriptions fit you, then you gave up your dreams of more than eight simultaneous munch-o-monsters on the screen and settled for less. Don't despair. There is a fourth possibility available.

It is a software package called Sprite-64, from Crosstech Graphics (2133 N. Fremont, Chicago, IL 60614; $49.95). It will (you guessed it!) let you display up to 64 different sprites simultaneously on the screen. The amazing thing is that the 64 sprites can be quite easily controlled from Basic programs. Sprite-64 also provides a simple software interface to both of the joysticks and to all four game paddles on the C-64.

The program provides support for 64 sprites by dividing the display screen into eight different zones, each one capable of containing eight separate sprites. You should understand that each zone is a unique area defined on the screen. Under normal conditions, a sprite cannot move from one zone into another.

A special function does exist that lets you define "wildcard sprites"—sprites that can be moved over the whole screen without regard for zone boundaries. However, as Crosstech points out in its 32-page documentation manual, you don't get something for nothing. Each wildcard sprite you use results in the loss of seven sprites from the total of 64. If you define two wildcard sprites, you have access to those two and 48 normal ones. That is still plenty of munch-o-monsters to contend with on the screen.

Sprite-64 is a wedge program that is transparent to you once it has been loaded into the machine. After you execute the program, the machine appears normal—with one major exception, a new command called Sprite.

You use the Sprite command in normal Basic program statements to control sprite graphics. The command uses a keyword format, in which various sprite parameters (such as sprite number, color, position and X/Y coordinates) are defined by unique keywords. This means that you need no more Pokes to the video display chip to control sprites in your program.

For example, the Basic program statement 10 SPRITE ZONE=5, SPNO=3,COLOR="GREEN",ON specifies the screen zone number as 5, the sprite number in the zone as 3 and green as the color of the sprite; it also enables the sprite for display to the screen. The keyword format is easier to use than Poking decimal equivalents of binary values to the video display chip on the C-64. Programs suddenly become much easier to read and debug, for you can tell exactly what the program statement is doing with specific sprites.

The documentation manual provided with the program is well written. It clearly explains program operation, how the zone system works and various Sprite command keywords.

Not for the Novice

I like this software a lot, but I wouldn't recommend it for the casual user. To fully use the power of Sprite-64, you should be very familiar with the sprite graphics concepts of the C-64. The program does not provide sprite/sprite or sprite/background collision support at this time, so you'll have to write appropriate routines to check for collision conditions.

The Sprite command also supports a videobank keyword that easily changes the memory bank that the video display chip uses. Since the manual gives no explanation of the video display chip functions and the results of different videobank selections, you have to understand these concepts if you're to get the most out of Sprite-64.

Crosstech describes Sprite-64 as a professional development tool. The program is actually the heart of a much larger software package known as SOS-64 (Sprite Operating System), which should be available when this review reaches print. The package will include a sprite editor, sprite library support (with sprites defined by name), and a sprite linker/loader. It will also support a sprite Move command that is apparently interrupt-driven at the machine code level in order to provide high-speed action graphics. The commands and keywords will also be accessible from assembly language programs, and an assembler vector map will be supplied with the package.

If you are a game programmer, either professional or a serious amateur, I highly recommend Sprite-64. It could be one of the best development tools you'll ever own.

Color 80

Way back when, in the early days of home computer kits, Don Lancaster was fond of pointing out that lots of expensive hardware could be replaced by letting the microprocessor in your system do more of the work, especially with screen displays. This is still true, and after all, if you aren't busy creating artistic displays in high-resolution memory, there is quite a bit of unused computer power going to waste.

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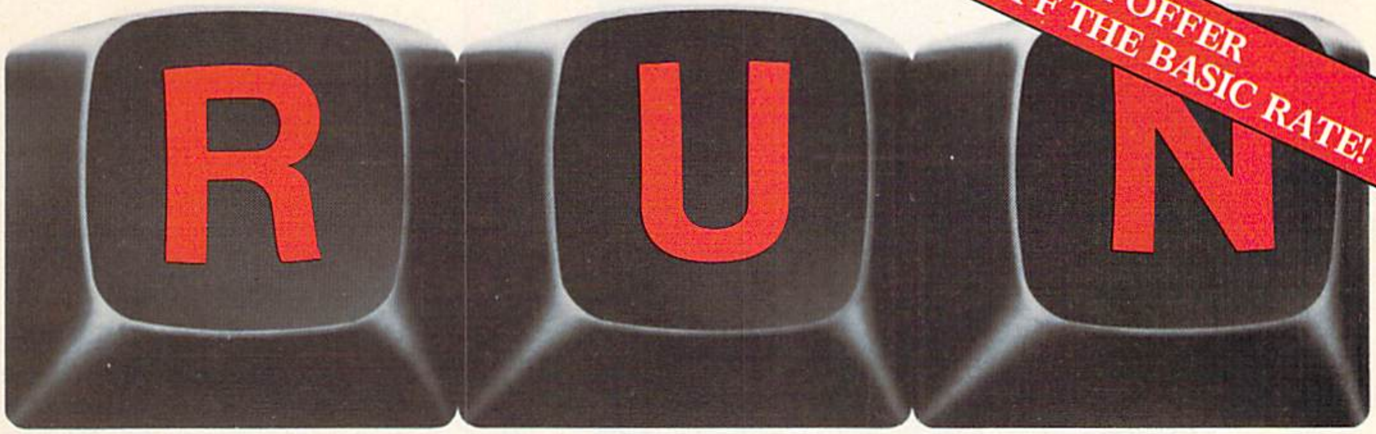

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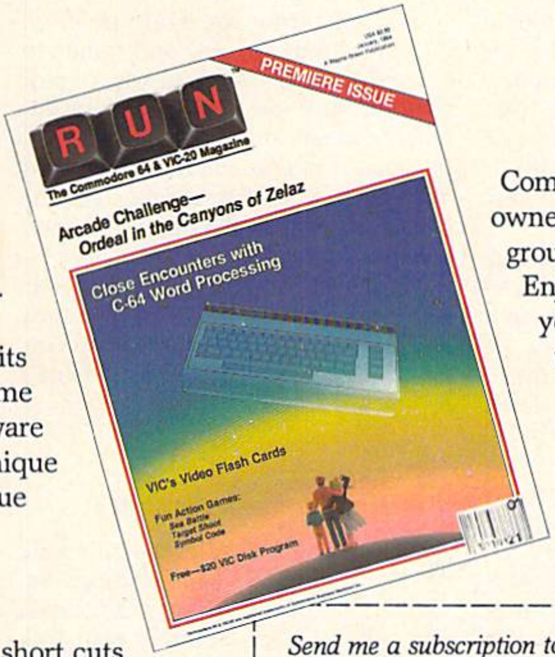
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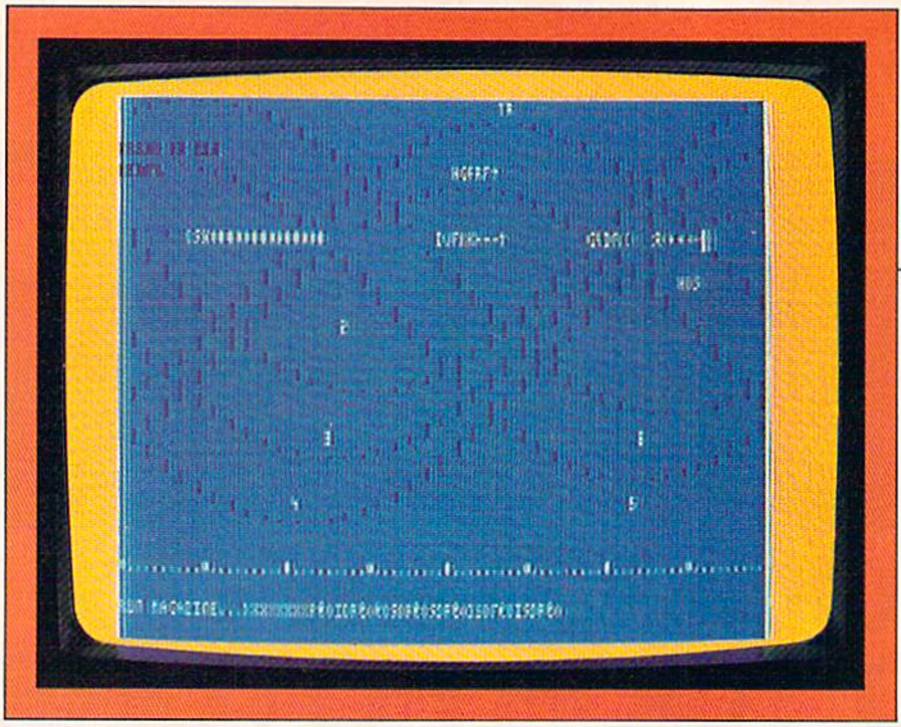

Create an instant 80-column screen with Color 80.

resolution screen into an 80-column text screen? Color 80 from Richvale Telecommunications (10610 Bayview Ave., Richmond Hill, Ontario L4C 3N8, Canada; $59.95) provides an easy method of adding 80 columns of text to your C-64 without requiring any extra hardware.

The program is supplied on disk and becomes transparent once you load and run it. That's all there is to it for an instant 80-column screen. A documentation sheet tells you how to switch back to a normal 40-column screen without erasing the Color 80 program from the machine.

No Basic memory is used in 80-column mode, since Color 80 is located under Basic, the kernal and the I/O. Color 80 does have a few drawbacks that should be pointed out. If you're using word processing software, like Quick Brown Fox, that protects itself to extremes against any foreign software being loaded, you won't be able to use Color 80 with it. Programs written in assembly language may not run well at all, and if you like to play Zork, you can't do it with Color 80 because the screen goes totally berserk.

However, adventure games or other programs written in Basic work very well with Color 80, especially since it's possible to have twice as many characters on the screen. If you are a Basic programmer, this is a great utility to have. Programs are easier to write and debug when you can display more program lines on the screen.

Text characters are fairly small on an 80-column screen and tend to "smear" when displayed on a color monitor. The smearing lessens considerably when the color control is turned down to minimum. When used on a black and white monitor like the Leedex Video 100, the display is supersharp and very easy to read.

If you would like to replace your 40-column screen with 80 columns and not have to add extra hardware to do it, try Color 80. It's a handy product.

Sorcerer's Apprentice

In multicolor high-resolution mode on the Commodore 64, the screen display is composed of 160×200 separate points. Each point is two dots (pixels) wide, so, as I said above, curved lines appear more jagged on a multicolor than on the standard high-resolution screen.

The visual impact of a multicolor word high-resolution display more than compensates for the reduced resolution. Multicolor screens can turn a text-oriented game or business application into a visual tour-de-force.

The same old problem still exists, however. You know what the machine can do, but how do you harness that power? Sorcerer's Apprentice (from Event Horizon Software, PO Box 1327, New York, NY 10028; $49.95) will enable you to indulge in total multicolor madness.

Sorcerer's Apprentice is an extensive high-resolution graphics utility that will help you create any image you can conceive of on a multicolor screen. The program is very user-friendly, but it takes a while to learn all the functions available. A small documentation booklet thoroughly describes the functions and the keys associated with them.

When you first use the program, it is impossible to remember all the various functions, so a Help command has been thoughtfully provided by Adam Bellin, the program designer. After you load the program, pressing the H key will display a summary of the functions. It takes three full help screens, however, to provide a complete summary of the functions. The program is simply awesome!

Program Operation

You create displays on the screen by drawing with a cursor, controlled by keyboard input or joystick. You can use the cursor to draw, erase or move transparently on the screen. You can draw one dot at a time or "paint" the actual cursor shape on the screen to create wide strokes of color. And if you don't like the cursor shape? No problem, since a total of nine separate cursor shapes are available.

The screen image can be composed of all 16 standard Commodore colors (three separate colors, plus the background color in any given 8×8 dot screen area). Three mixing colors are available for drawing at any one time. The same color choices are available for the screen background and border, and you can change the background color without affecting the drawing already on the screen.

Many common forms are rather difficult to draw freehand, but the program's built-in drawing function take care of this problem. By pressing the appropriate function key, you can easily create rectangles, triangles, circles, ovals, and straight lines between two selected points.

Another special function lets you fill in any enclosed shape on the screen with a particular color. Once you have

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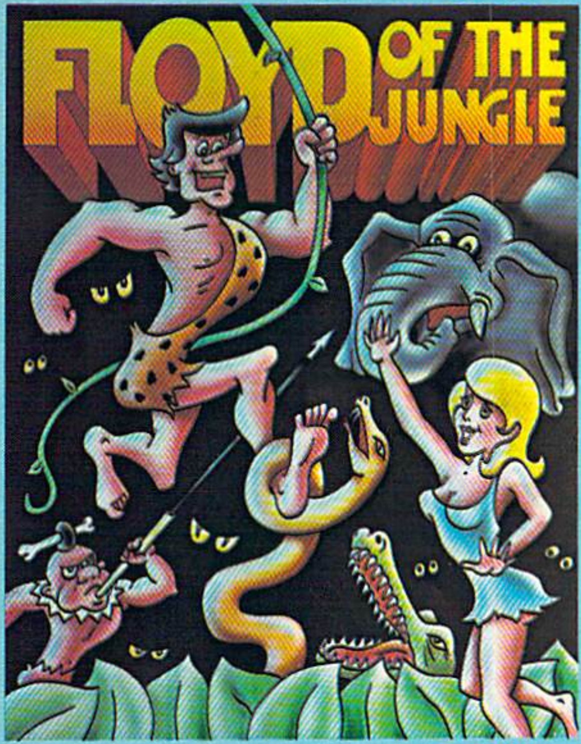

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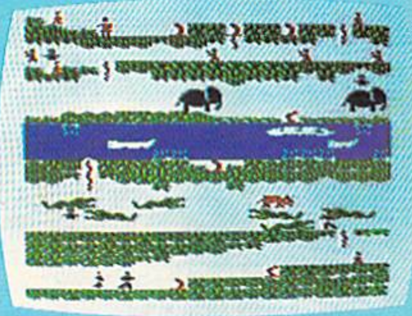

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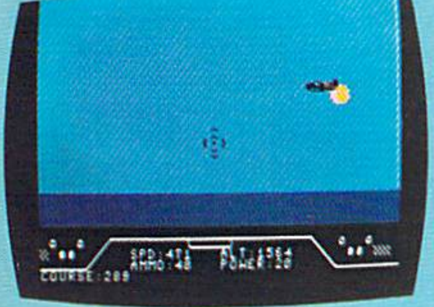

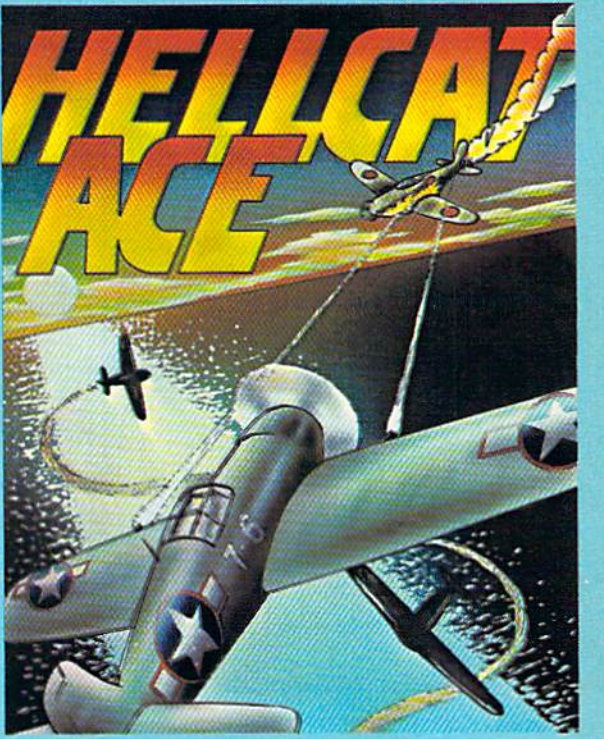

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created shapes or forms on the screen, you might want to reproduce the same shapes in another area of the drawing. Sorcerer's Apprentice provides a function to let you do exactly that. You can bracket any portion of the screen between two diagonal points and move it to any other area of the screen you wish. And that isn't all, folks.

Fine detail is sometimes hard to draw when squinting at all those dot positions, so the program gives you a magnification function. Any 40 × 50 dot screen area can be magnified into a full screen work area. In this mode, you can scroll the entire magnified screen to the left, right, up or down, in relation to the full high-resolution screen. You can also use the magnified screen to design your own custom character fonts, since another function lets you mix text characters with the high-resolution graphics on the screen. Text fonts can be created and stored in different disk files for future use.

When you have completed a screen image, it can be stored on disk and later reloaded by the program for further modification. You can also load the screen image from Basic for use in your own application or game programs. Instructions are given in the documentation booklet for loading a stored screen image from disk by using Basic statements. This will allow you to call a high-resolution screen from disk, display it, and then switch back to normal text mode from a Basic program.

The screen load from Basic works exactly as it is described in the documentation, but there is one small problem. The example works in immediate mode, but goes into a perpetual loop when executed from a Basic program. This is because Commodore Basic executes the same statement number again after a load command issued from a Basic program. In order to load a program file to a specific location and then continue program operation, you must include an If statement before the load command on the same line.

An example would be the Basic statement: 100 IF A = 0 THEN A = 1 :LOAD"XXXXX",8,1. The variable A can be any variable name as long as the value is 0 when the line is executed. The program will execute the If statement in line 100, then the load, then try to execute line 100 a second time. Since the conditions of the If statement are not met the second time through, the program will go to the next statement number and continue normally. As far as I know, this is the only minor detail that the documentation booklet overlooks.

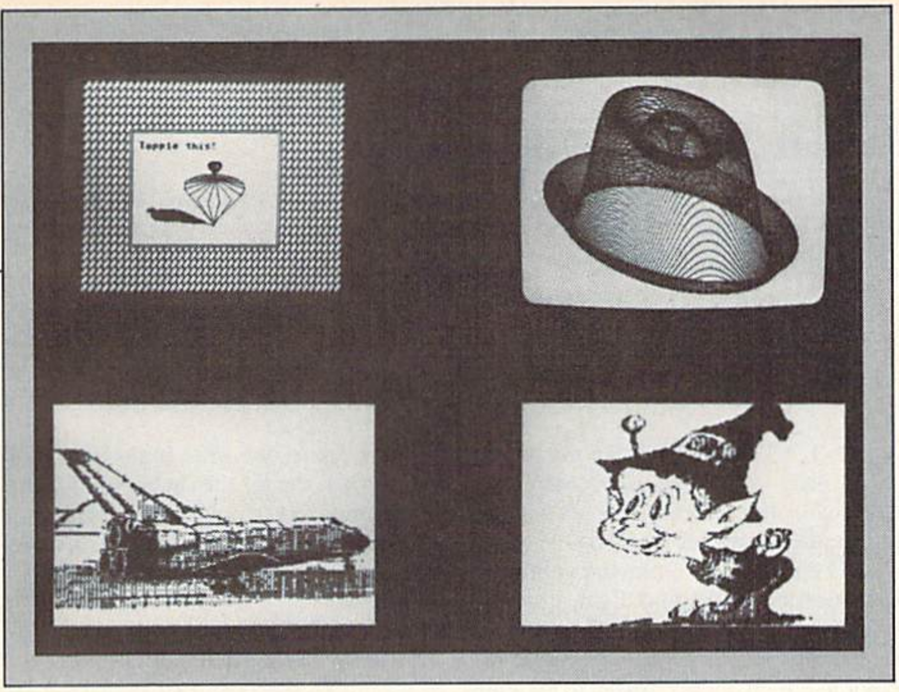
Sorcerer's Apprentice is only available for disk-based systems and is written in assembler language, so there is no noticeable delay when different functions are selected. It is a truly excellent software package and will allow your own personal creativity to express itself in multicolor graphics imagery on the C-64.

'64 Panorama

In high-resolution mode, the Commodore 64 display screen is composed of 320 × 200 separate points. Just thinking about translating 64,000 bit values into 8,000 bytes and then Poking the bytes into high-resolution screen memory made my head hurt, so again I had another rainy-day-with-lots-of-time project lurking behind the disk drive. Lately, however, I've been computing while the sun shines with the help of '64 Panorama, a high-resolution graphics program from Midwest Micro Associates (PO Box 6148, Kansas City, MO 64110; $29.95).

'64 Panorama lets you create high-resolution drawings on the display screen by using joystick input to control a graphics "pen" that can draw, erase or float over the high-resolution screen. You can select pen options to draw either wide or narrow lines. A straight line is drawn between two defined points on the screen when the fire button on the joystick is depressed.

Drawings created with the program



There's a problem with '64 Panorama: Creating hi-res graphics can be addictive.

can be in any one of 16 colors. You can also change background and border to any of the 16 standard colors provided by the C-64. When a drawing is complete, you can store it on tape or disk for later use or further modification. Drawings can also be printed out in high-resolution mode on a Commodore 1515 or 1525 printer.

At first glance the program might seem limited, for it doesn't support multicolor high-resolution graphics. But when multicolor graphics are used, screen resolution is reduced to 160×200 points, and much of the high-resolution effect is lost (curved lines and diagonals become more jagged). Multicolor high-resolution screen dumps to a black and white printer are equally unacceptable, so the choice to keep the drawing a single color is quite reasonable.

The program tape or disk comes complete with a picture library composed of nineteen high-resolution images that you can load and display on the high-resolution screen. These images are not just sketches, but digitized pictures that demonstrate the high-resolution capabilities of the C-64.

You can modify the digitized pictures for hardcopy printout or use with other programs. The program also allows you to add text and the standard Commodore graphics characters to the graphics display, along with the high-resolution drawing. The multigraphics support is great for designing and printing your own custom greeting cards or announcements.

'64 Panorama includes a separate utility program to draw circles. After you have used the circle-generating program, you can reload '64 Panorama without destroying the high-resolution screen, and then proceed to do more work on the drawing.

The program is extremely easy to use. It provides a directory and command-line function for disk users, so that once running, the program doesn't have to be exited to send commands to the disk drive. The only problem with '64 Panorama is to keep program use by your spouse, children and friends to a reasonable level, so that you also can enjoy the program. Creating high-resolution graphics can be addictive.

The same program, called VIC PICS, is offered for VIC-20 owners. A similar picture library is supplied with the program, and the only major difference between the two versions is that the VIC software is designed for the VIC's 160×176 dot high-resolution screen. An 8K memory expansion is required to support the full-featured VIC program, but a reduced program version that will run on an unexpanded 5K machine is also available. The 5K version simply uses a smaller drawing area because of memory limitations. Ⓡ

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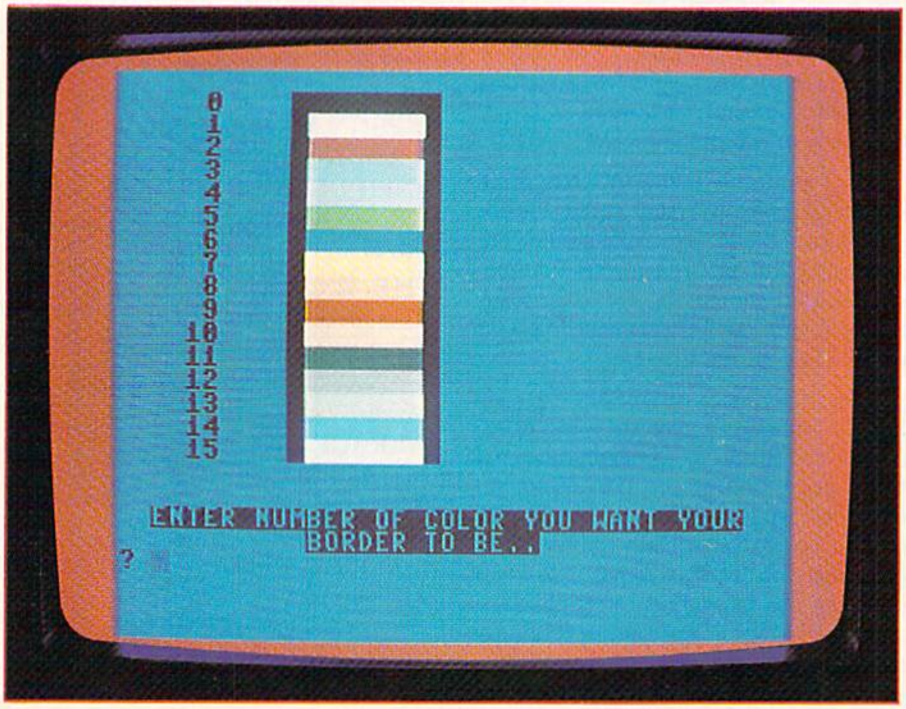
Stop Poking Around—
Shortcut to Color

Recalling and using the color codes for the Commodore 64 can be a real headache without the manual.

By David E. Stanfield

POKE 53281,0. Oh fine; my screen turns black as I exercise color-power over my Commodore 64. Not too good; maybe dark gray will work better.

All I need to do is Poke the right code into location 53281 and I can instantly change the background color on the screen. My problem is that the list of color codes is in my owner's manual, which happens to be at home.



```
 0
 1
 2
 3
 4
 5
 6
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 8
 9
10
11
12
13
14
15

ENTER NUMBER OF COLOR YOU WANT YOUR
           BORDER TO BE..
?
```

I've taken my computer and Datassette recorder to a friend's to show off a great program I'm proud of. The cassette player has allowed me to load in my program, but I'm using his television and it has horrible color. The color combination I worked out at home looked great on my monitor. Here, it's perfectly ghastly.

Desperately, I try another Poke, and now the screen goes completely blank! My mind is beginning to do the same, and Pete's silly snickering doesn't help.

Then I figure out what happened; that last Poke made the background the same color as the characters. Displaying black characters on a black background displays a lot of black and little intelligence.

Eventually, I Poked my way out of trouble but it was all a bit awkward.

Color Combinations Galore

After all, there are 16 colors available for the border around the printing area of the screen, 16 colors for the character set and 16 for the background. Disallowing the use of the same color for both background and character set, there are 16 × 16 × 15, or 3840 different color combinations available on the Commodore 64. Trying them all can take a lot of Pokes into specific memory locations.

The simple solution was to write a utility program that could be made part of all future applications programs. After all, a 64K machine certainly has plenty of memory available.

One thing was certain; I didn't want to have to remember anything. Too many times I've used programs intensively for a few weeks, gone on to other projects for months and then returned to the original program. All of a sudden, I'd be unable to remember that this program used Control W to cause all output to be diverted to the 40-column matrix printer. The printer would just sit there completely idle, and the only way out was to try to find the original documentation or to go through the program enough times to see how it worked.

The Program

The Color Setter program in Listing 1 is designed to make changing the border, background and character set colors very easy. All 16 colors are displayed beside their codes, and you are asked to enter your choice. Should you enter a code outside the correct limits, error messages appear briefly, the colors are redisplayed and the question is

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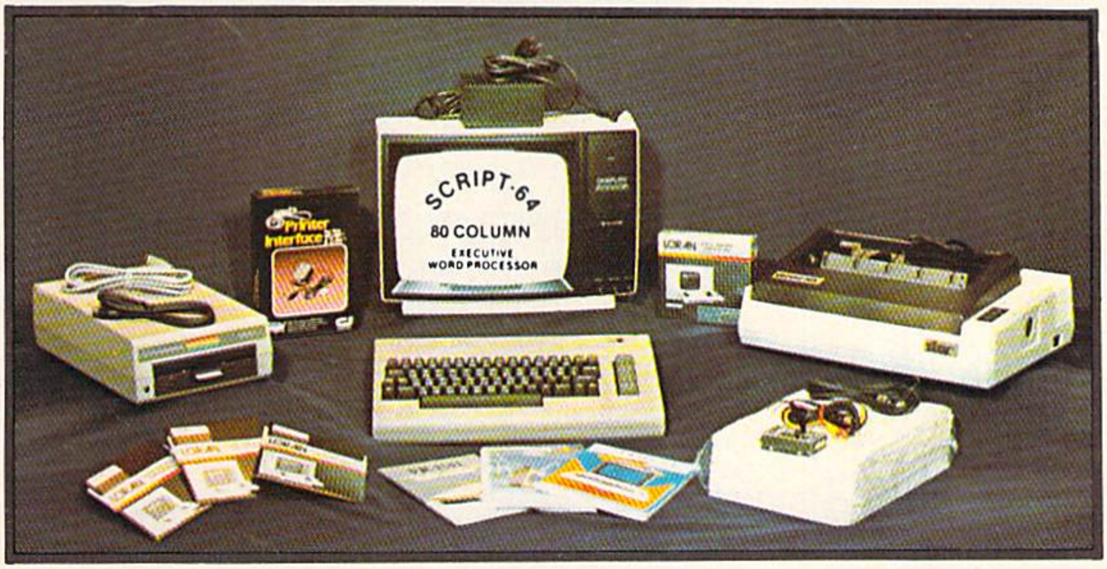

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```
9000 REM  SET COLORS
9010 C=1
9020 B$="ENTER NUMBER OF COLOR YOU WANT YOUR"
9030 C$="BORDER TO BE.."
9040 D$="BACKGROUND TO BE.."
9050 E$="CHARACTERS TO BE.."
9060 REM   DISPLAY COLOR CHOICES
9070 PRINT CHR$(147): FOR A=0 TO 15
9080 IF A>9 THEN PRINT TAB(3);A;
9090 IF A<10 THEN PRINT TAB(4);A;
9100 PRINT TAB(10);CHR$(18);
9110 FOR B=0 TO 8:PRINT CHR$(32);:NEXT B: PRINT:NEXT A
9120 FOR A=0 TO 15:FOR B=1TO 7
9130 POKE 55306+B+(40*(A+1)),A
9140 NEXT B: NEXT A
9150 PRINT:PRINT:PRINT SPC(2);CHR$(18);B$
9160 ON C GOTO 9170,9180,9190
9170 PRINT SPC(11);CHR$(18);C$:GOTO 9200
9180 PRINT SPC(9);CHR$(18);D$:GOTO 9200
9190 PRINT SPC(11);CHR$(18);E$
9200 INPUT A:IF A>15 THEN PRINT "TOO HIGH":GOTO9230
9210 IF A<0 THEN PRINT "TOO LOW":GOTO9230
9220 GOTO 9240
9230 FORA=1 TO 1000:NEXT A:GOTO 9060
9240 A=INT(A)
9250 ON C GOTO 9260,9270,9290
9260 POKE 53280,A:GOTO 9350
9270 IF PEEK(646)= A GOTO 9320
9280 POKE 53281,A:GOTO 9350
9290 IF A=PEEK(53281)-240 GOTO 9320
9300 POKE 646,A
9310 GOTO 9350
9320 PRINT "REDO...CHARACTERS AND BACKGROUND CAN NOT"
9330 PRINT"BE THE SAME COLOR.":FOR A=1 TO 3000:NEXT A
9340 GOTO 9060
9350 PRINT"IF YOU ARE SATISFIED,ENTER (Y)."
9360 INPUT A$
9370 IF A$="Y" THEN 9390
9380 GOTO 9060
9390 ON C GOTO 9400,9410,9420
9400 C=2:GOTO 9060
9410 C=3:GOTO 9060
9420 PRINT CHR$(147);"IF YOU ARE SATISFIED WITH ALL THREE"
9430 PRINT"COLOR SELECTIONS, ENTER (Y)."
9450 INPUT A$:IF A$="Y" GOTO 9470
9460 GOTO 9010
9470 PRINT"ALL DONE"
9480 RETURN
```

Listing 1. Color Setter program.

repeated. The utility also prevents you from making the background and character set colors the same.

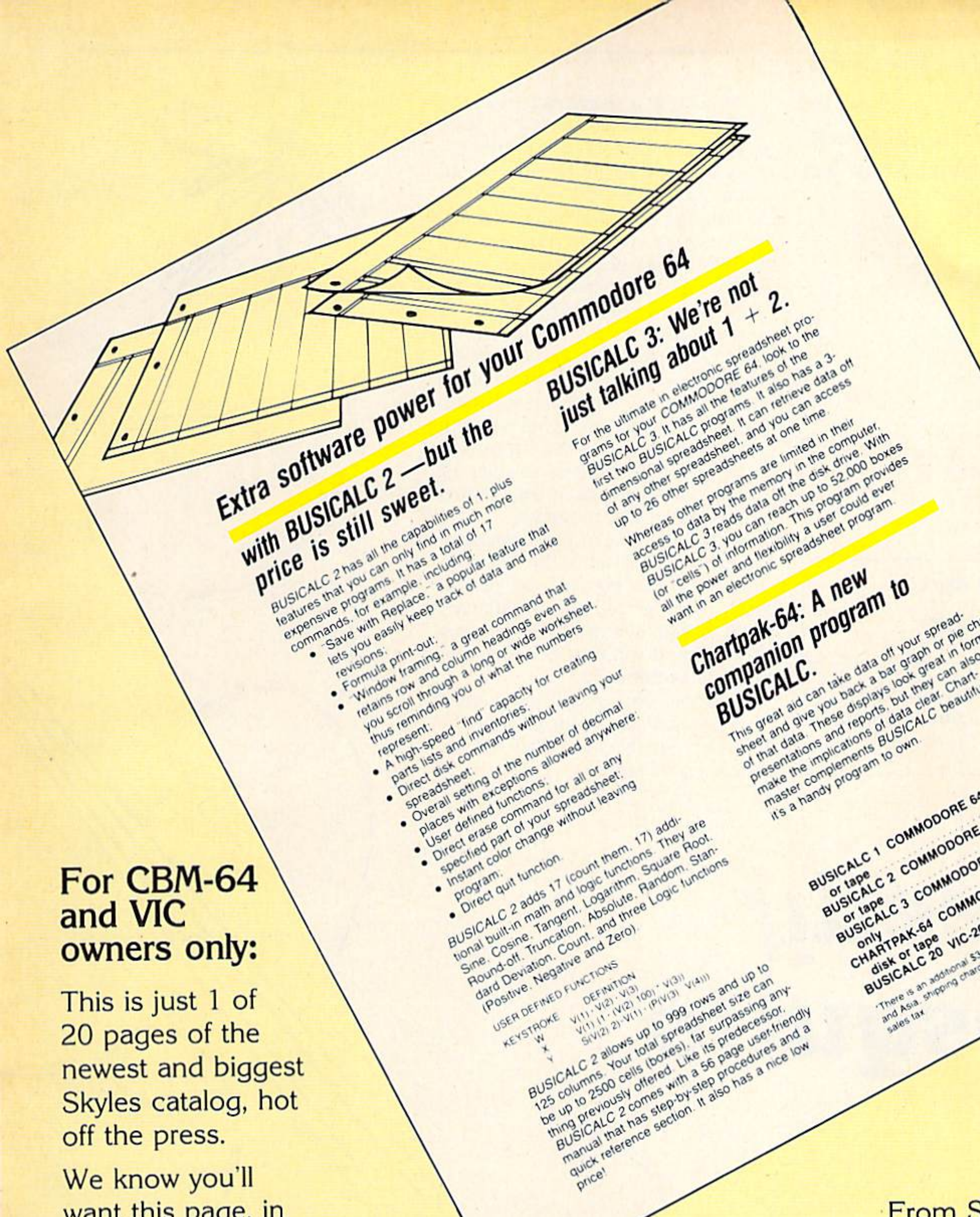
When you enter a correct code, it is automatically Poked into the proper location. Thus, your choice is immediately implemented, and you are then asked if it is satisfactory. If you indicate that it is, you proceed with other matters; otherwise you repeat the above until you are happy.

The program treats all three color parameters in this fashion, and after completing the last of them, you are given a chance to repeat everything. You do not need to exit this program until you are completely satisfied.

If you look at the program listing, you will notice that it is numbered 9000 and above. This is because I designed it for use as a subroutine in future programs, where it would be located higher than the rest of the program. Before actually writing a new program, I load Color Setter from tape and then start programming.

At some point in the new program, a GOSUB 9010 gives me the opportunity to set up my colors. Of course, the GOSUB could be turned into a GOTO if the last line of Color Setter were changed from a Return to another GOTO.

One final point: This utility is written in Basic and uses several string and numeric variables. An easy way to keep Color Setter from clobbering your program if the program uses the same variables (for example, A$) is to call Color Setter *before* your program uses those variables. R



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USER DEFINED FUNCTIONS

KEYSTROKE	DEFINITION
W	V(1) · V(2) · V(3)
X	V(1) (1 · (V(2) 100) · V(3))
Y	S(V(2) 2)-V(1) · (P(V(3) V(4)))

BUSICALC 2 allows up to 999 rows and up to 125 columns. Your total spreadsheet size can be up to 2500 cells (boxes), far surpassing anything previously offered. Like its predecessor, *BUSICALC* 2 comes with a 56 page user-friendly manual that has step-by-step procedures and a quick reference section. It also has a nice low price!

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Speedy Mosquito

Speedy little mosquitoes are your prey in this fast-paced game for the C-64. Swat 'em quick to score big!

By Charles T. Kowal

RUN It Right

Commodore 64
Joystick

Address author correspondence to Charles T. Kowal, 3041 Alabama St., La Crescenta, CA 91214.

Mosquito is a simple but entertaining game, written completely in Basic for the C-64. The object is to swat the mosquito. You do this by moving your swatter with a joystick connected to Port 1. The mosquito moves around the screen at random (just like real life). When you swat at the mosquito, you have only one chance in nine of actually hitting it (just like real life)!

After you swat two mosquitoes, the other mosquitoes get angry, and big ones begin to appear in random places on the screen. If you or the little mosquito hit a big mosquito, you and your prey will get moved to different places on the screen. Sometimes you can use this to your advantage, if your swatter is far from the little mosquito.

But beware! One of the big mosquitoes is a killer. If you or the little mosquito touch this big one, the game is over. There is no way of knowing which mosquito is the killer until you hit it. Then it will turn red, and your score will be displayed.

After you swat ten little mosquitoes, the game ends, and your total time is displayed. Anything less than 100 seconds is a good score.

Splats and Sprites

The program begins with a title screen, then a setting up message. During these preliminary displays, the computer is busily transferring the character set into RAM memory. This allows you to create your own characters.

Lines 130–160 create the little mosquito character and a "splat" character. Lines 1000–1060 create the sprites for the big mosquitoes. There are two sound effects in the program: the buzz of the mosquito and the sound of a swat. These sounds are created in lines 260–330 and 900–980, respectively. Lines 560–580 create the random mosquito movements.

After the computer finishes its initial setup, start the game by pressing the joystick fire button. You do *not* need to press this button to swat the mosquito. Just move the swatter to the little mosquito and keep it on top of him. Eventually the little insect will be swatted, but you must keep up with it and avoid the big mosquitoes.

Happy hunting! ®

Listing 1. Mosquito program for the C-64.

```
10 PRINT"[SHFT CLR]":FORI=1TO5:PRINT:NEXT:PRINTTAB(16);
     "MOSQUITO"
15 PRINT:PRINT:PRINTTAB(19);"BY"
20 PRINT:PRINT:PRINTTAB(12);"CHARLES T. KOWAL":N=0:Q=16
     0:R=110:G=1
30 POKE53269,0:POKE53277,1:POKE53271,1:POKE53279,0:GOSU
     B1000
35 REM****   TRANSFER CHARACTER SET TO RAM   ****
40 POKE56334,PEEK(56334)AND254:POKE1,PEEK(1)AND251
50 FORI=0TO263:POKEI+12288,PEEK(I+53248):NEXT
60 PRINT"[SHFT CLR]SETTING UP CHARACTER TABLE"
70 FORI=384TO495:POKEI+12288,PEEK(I+53248):NEXT
80 FORI=816TO823:POKEI+12288,PEEK(I+53248):NEXT
90 FORI=1024TO1287:POKEI+12288,PEEK(I+53248):NEXT
100 FORI=1408TO1519:POKEI+12288,PEEK(I+53248):NEXT
110 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334)OR1
120 POKE53272,(PEEK(53272)AND240)+12
125 REM****   MAKE MOSQUITO CHARACTER   ****
130 M=12288:POKEM,144:POKEM+1,80:POKEM+2,50:POKEM+3,252
     :POKEM+4,82:POKEM+5,73
140 POKEM+6,136:POKEM+7,132
145 REM****   MAKE 'SPLAT'   ****
150 M=M+1248:POKEM,137:POKEM+1,74:POKEM+2,36:POKEM+3,0:
     POKEM+4,0:POKEM+5,36
160 POKEM+6,74:POKEM+7,137
170 PRINT"[SHFT CLR]"
180 PRINT"PRESS FIRE BUTTON TO START"
190 IFPEEK(56321)<>239THEN190
200 POKE53269,0:POKE53277,PEEK(53277)AND254:POKE53271,P
     EEK(53271)AND254
210 POKE53279,0:YY=INT(8*RND(0)):ZZ=2[UP ARROW]YY
220 PRINT"[SHFT CLR]":FORN=56256TO56295:POKEN,14:NEXT
225 FORN=55296TO56255:POKEN,1:NEXT
230 FORN=1984TO2023:POKEN,160:NEXT:REM  CLEAR BOTTOM LI
     NE
240 SC=1524:DX=0:DY=0:SD=1024:CT=0:G=0:TM=TI/60
250 MD=MC:POKEMD,32:MC=1024+INT(960*RND(0)):POKEMC,0:PO
     KESC,102
255 REM****   MOSQUITO SOUND   ****
260 S=54272:FL=0
270 POKES+24,0
280 POKES+1,100
290 POKES+5,219
300 POKES+15,28
310 POKES+24,15
320 POKES+4,19
330 FORT=1TO200:NEXT:POKES+4,18
375 REM****   READ JOYSTICK   ****
380 JV=15-(PEEK(56321)AND15):DX=0:DY=0
400 IFJV=1THENDY=-40:POKESD,32:GOTO490
410 IFJV=2THENDY=40:POKESD,32:GOTO490
420 IFJV=4THENDX=-1:POKESD,32:GOTO490
430 IFJV=5THENDX=-1:DY=-40:POKESD,32:GOTO490
```

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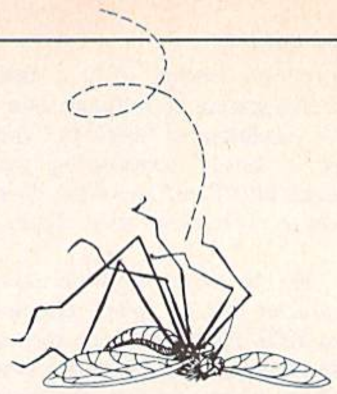

```
440 IFJV=6THENDX=-1:DY=40:POKESD,32:GOTO490
450 IFJV=8THENDX=1:POKESD,32:GOTO490
460 IFJV=9THENDX=1:DY=-40:POKESD,32:GOTO490
470 IFJV=10THENDX=1:DY=40:POKESD,32
490 SC=SC+DX+DY:IFSC>1983THENSC=SC-960
500 IFSC<1024THENSC=SC+960
510 POKESC,102:SD=SC
520 XX=PEEK(53279):IFXX=ZZTHENPOKE53287+YY,2:XX=0:POKE5
     3269,ZZ:GOTO800
530 IFXX<>0THENPOKESD,32:SC=SC+INT(10*RND(0)):SD=SC:POK
     ESC,102:XX=0:GOTO250
540 POKES+4,19:FORT=1TO10:NEXT:POKES+4,18
550 DX=0:DY=0
560 MX=INT(RND(0)*3):MX=MX-1
570 MY=INT(RND(0)*3):MY=(MY-1)*40
580 MD=MC:MC=MC+MX+MY
590 IFMC>1983THENMC=MC-960
600 IFMC<1024THENMC=MC+960
610 IFMC=SCTHENTN=TI/60:GOTO900
620 POKES+4,19:FORT=1TO10:NEXT:POKES+4,18
630 POKEMD,32:POKEMC,0:GOTO380
700 CT=CT+1
710 IFCT>9THENPOKE53269,0:GOTO800
720 IFCT<2THEN740
730 N=CT-2:RESTORE:Q=155*RND(0):R=175*RND(0):G=2*G+1:GO
     SUB1040
740 POKE1984,147:POKE1985,131:POKE1986,143:POKE1987,146
     :POKE1988,133
750 POKE1989,189:POKE1990,(CT+176)
760 POKESC+54272,1:GOTO250
800 POKEMD,32:POKEMC,32
810 PRINT"[SHFT CLR]","[CTRL 9]GAME OVER[CTRL 0]":PRINT
     "TIME=";INT(TN-TM+.5);"SECONDS"
820 PRINT"SCORE=";CT:POKE53279,0:POKES+24,0
830 PRINT"[CRSR DN][CRSR DN][CRSR DN][CRSR DN][CRSR DN]
     PRESS FIRE BUTTON TO START AGAIN":FL=1:GOTO190
895 REM****   SWATTING SOUND   ****
900 FORL=0TO24:POKES+L,0:NEXT:POKESC,156:POKEMD,32:POKE
     SC+54272,7
910 POKES,240:POKES+1,33
920 POKES+5,8
930 POKES+22,104
940 POKES+23,1
950 POKES+24,79
960 POKES+4,129
970 FORT=1TO250:NEXT:POKES+4,128
980 FORL=0TO24:POKES+L,0:NEXT
990 GOTO700
1000 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,97,0,0,99,0,0,54,0,0
      ,54,0,0,28,0,1,255,64
1010 DATA3,255,224,0,218,32,1,85,16,2,84,136,2,84,128,4
      ,146,128,0,0,0,0,0,0,0,0
1020 DATA0,0,0,0,0,0,0
1030 FORI=2040TO2047:POKEI,13:NEXT
1040 FORI=0TO62:READZ:POKE832+1,Z:NEXT
1050 V=53248:POKEV+2*N,R+50:POKEV+1+2*N,Q+40
1060 POKEV+16,0:POKEV+21,G:POKEV+39+N,1
1070 IFPEEK(53279)<>0THENMD=MC:POKEMD,32:MC=MC+5:SD=SC:
      POKESD,32:SC=SC+5
1080 RETURN
```

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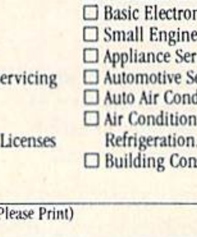

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Operation File Handler: Database Deluxe to the

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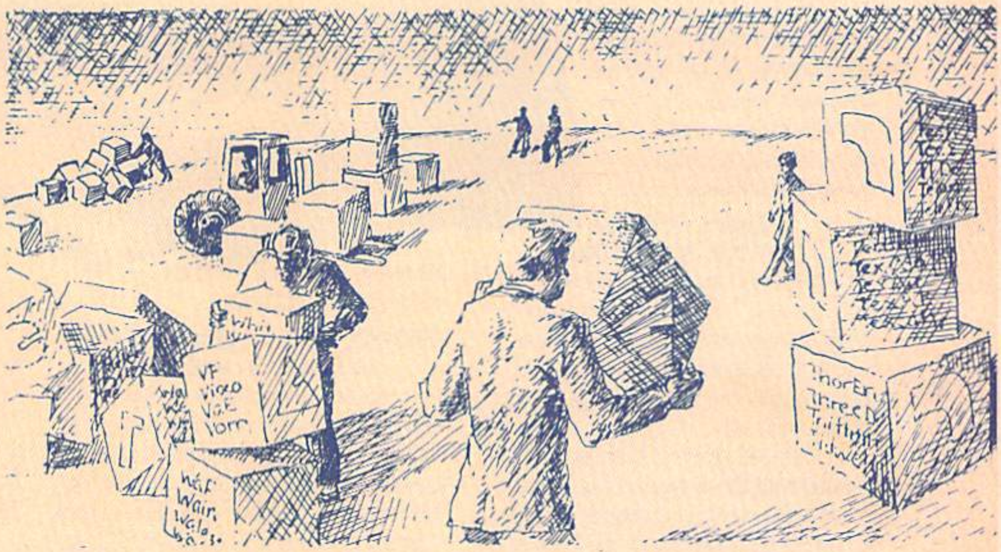


By John Stilwell

Deluxe File Case is a file handler for the Commodore 64 or for the VIC-20 with a memory expansion of 3K or more. The program is designed to use the 1540 or 1541 single disk drive or the Commodore Datassette. For printouts, it will work with any of the VIC printers.

The file format is a group of pages with ten entries per page. In the VIC-20 version, line 30 looks at the amount of memory available for data storage and then gives you the optimum number of pages. This means that if you change the size of the program, it will notice and will change the number of pages it gives you.

RUN It Right

VIC-20 with 3K or more of expanded memory, or Commodore 64
1540 or 1541 disk drive or
Commodore Datassette

Address author correspondence to John Stilwell, 5018 Marathon Drive, Madison, WI 53705.

In the C-64 version, you are always given 100 pages with ten entries on each page. On line 30, N is set to 1000, the number of entries that the file can hold. If you want more or fewer pages, all you have to do is change this number.

When you run the program, you will first be asked for a file name. If you push the return key without providing a name, the file name will default to "Noname." The program then sets itself up.

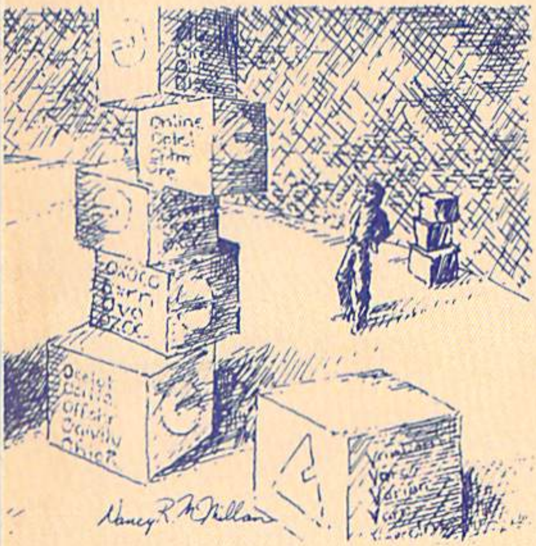
A moment later, the list of one-letter commands will appear on the screen. The commands that you have are: Page, Insert, Enter, Catalog, Alphabetize, Kill, New, Load, Save, Hard Copy and Help. If you should ever forget what they mean, push the ? key for the list of definitions.

Using the Commands

To call up a page, push P and the page number that you want. (A flashing cursor will remind you to push the return key after typing in something that was asked for.) When the page appears, you will see ten entry numbers with a dash after each one. To make an entry, push E and type in one of the numbers to indicate where you want the entry to go. The entry must not contain any commas, colons or semicolons. After you have pushed the return key, the entry will appear on the page.

If you want the entry to appear in the catalog, it has to be reversed (lettering inside a colored bar). To do this, the first character of the entry must be a left arrow. This is the key in the upper left-hand corner of the keyboard.

Rescue!



I reverse such things as the titles of categories. For example, you might want to organize a book list by authors. To do this, reverse each author's name and enter his books after the name. (The book titles are *not* reversed.) Now, whenever you call the catalog, each author's name will be shown with the page number on which it appears.

To insert something between two already existing entries, push I and type the number of the line that you want the insertion to go on. If you want to kill (erase) an entry, push K and type in the entry number. To cancel a command like Kill, just type in another command letter instead of the entry number.

If you want to skim over pages, push the space bar instead of a command letter. To call up the catalog, push C. Due to the limited amount of space on the screen, only ten categories with their page numbers can be displayed at a time. Push the return key to get the next

Listing 1. Deluxe File Case program for the VIC-20.

```
1 T$="NO NAME":PRINT"[SHFT CLR]FILE NAME":INPUTT$:T$=LE
     FT$(T$,14)
2 N=INT(FRE(0)/20):P=1:X=(N+1)/10:DIMS$(N):POKE36879,18
     5:R$=" LINE#":GOSUB81
3 F$=CHR$(15):G$=CHR$(8):GOTO8
4 K=0
5 Q=0:PRINT"[SHFT CLR][CTRL 1][CTRL 9]CATALOG: ";T$:PRI
     NT"PAGE
6 FORJ=KTON:IFASC(S$(J))=18THENPRINT"[CRSR LF]"INT(J/10
     +1);S$(J):Q=Q+1:IFQ>10THEN8
7 NEXTJ
8 GOSUB26:IFA=0THEN8
9 ON A GOTO4,12,19,22,29,36,41,67,47,52,31
10 IFJ<N+1THENK=J:GOTO5
11 GOTO4
12 PRINT"[CRSR DN][CRSR DN]PAGE#":INPUTA$:P=VAL(A$):GOS
     UB27:IFA<>0THEN9
13 IFP<1ORP>XTHENPRINT"[3 CRSR UPS]":GOTO12
14 PRINT"[CTRL 9][SHFT CLR]PAGE"P;T$:FORI=0TO9:L=(P-1)*
     10+I:PRINT"[CRSR LF]"L;S$(L):NEXT
15 GOSUB26:IFA=0THEN15
16 IFA<>12THEN9
17 P=P+1:IFP>XTHENP=1
18 GOTO14
19 A$="-1":PRINT"[CRSR DN][CRSR DN]ENTER"R$:INPUTA$:J=V
     AL(A$):GOSUB27:IFA<>0THEN9
20 IFJ<0ORJ>INT(X)*10+1THENPRINT"[5 CRSR UPS]":GOTO19
21 INPUTS$(J):GOTO116
22 A$="-1":PRINT"[CRSR DN][CRSR DN]INSERT"R$:INPUTA$:J=
     VAL(A$):GOSUB27:IFA<>0THEN9
23 IFJ<0ORJ>INT(X)*10+1THENPRINT"[5 CRSR UPS]":GOTO22
24 PRINT"ENTRY":INPUTD$:PRINT"INSERTING":IFR=NTHEN14
25 GOSUB86:FORI=KKTOJ+1STEP-1:S$(I)=S$(I-1):NEXT:S$(J)=
     D$:GOTO116
26 E$="C,P,E,I,N,S,L,H,K,A,?[CTRL 0] ":PRINT"[CTRL 9][C
     RSR DN]"E$"[CRSR LF][CRSR UP][CRSR UP]":GOSUB63
27 A=0:FORI=1TO13:IFMID$(E$,I*2-1,1)=A$THENA=I:I=13
28 NEXTI:RETURN
29 GOSUB66:IFA$<>"Y"THEN4
30 PRINT"NEW FILE NAME":INPUTT$:GOSUB81:GOTO4
31 PRINT"[SHFT CLR][CTRL 9]C[CTRL 0]ATALOG[CRSR DN]":PR
     INT"CALL [CTRL 9]P[CTRL 0]AGE[CRSR DN]":PRINT"[CTR
     L 9]I[CTRL 0]NSERT"R$
32 PRINT"[CRSR DN][CTRL 9]E[CTRL 0]NTER"R$:PRINT"[CRSR
     DN][CTRL 9]K[CTRL 0]ILL"R$:PRINT"[CRSR DN][CTRL 9]
     A[CTRL 0]LPHABETIZE":PRINT"[CRSR DN][CTRL 9]N[CTRL
      0]EW FILE[CRSR DN]"
33 PRINT"[CTRL 9]L[CTRL 0]OAD FROM TAPE OR DISC":PRINT"
     [CTRL 9]S[CTRL 0]AVE TO TAPE OR DISC[CRSR DN]"
34 PRINT"[CTRL 9]?[CTRL 0] DEFINITIONS":PRINT"[CRSR DN]
     [CTRL 9]H[CTRL 0] LIST TO PRINTER[CRSR UP]":GOSUB2
     6:IFA=0THEN31
35 GOTO9
36 PRINT"[SHFT CLR][CTRL 1]SAVE TO TAPE OR DISC":GOSUB6
     6:IFA$<>"Y"THEN4
37 PRINT"[CTRL 9]D[CTRL 0]ISC OR [CTRL 9]T[CTRL 0]APE?"
     :GOSUB63:IFA$="T"THEN40
38 IFA$<>"D"THEN4
39 OPEN15,8,15,"UI-":CLOSE15:OPEN2,8,2,"@0:"+T$+" [SHFT
      X],S,W":J=2:GOTO89
40 OPEN1,1,1,T$:PRINT#1,T$:J=1:GOTO89
41 PRINT"[SHFT CLR][CTRL 9]LOAD FROM TAPE OR DISC":GOSU
     B66:IFA$<>"Y"THEN4
42 PRINT"[CTRL 9]D[CTRL 0]ISC OR [CTRL 9]T[CTRL 0]APE?"
     :GOSUB63:IFA$="T"THEN46
43 IFA$<>"D"THEN4
44 GOSUB97:PRINT"[CRSR DN]FILE NAME?":INPUTN$:IFN$=""TH
     EN4
45 OPEN15,8,15,"UI-":CLOSE15:OPEN2,8,2,"0:"+N$+" [SHFT
     X],S,R":J=2:GOTO93
46 OPEN1,1,0:J=1:GOTO93
```

More →

ten categories.

To save or load a file, push S or L respectively. You'll be asked to confirm your intentions. You wouldn't want to load in a file when you're not yet done with the one that's in the computer. Next, you'll be asked whether you're using a disk or tape drive. Push D for disk or T for tape. If you push D, you'll be asked if you want a listing of the data files that are on the disk.

When resaving a file to the disk, the old one will be replaced by the new one. This relieves you of trying to remember which version of a file is the most recent one.

Push A to alphabetize. You can only alphabetize what is inside of a category. If your categories are authors' names, then you can alphabetize the books by each individual author, but you cannot alphabetize the authors themselves. After pushing A, you will be asked for the number of the first entry to be sorted.

If you have trouble typing in this program, send me a self-addressed, stamped mailer with a cassette or disk. I will be happy to record the program and send it to you. R

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Listing 1 continued.

```
47 PRINT"[CRSR DN][CRSR DN]KILL"R$:INPUTA$:J=VAL(A$):GO
     SUB27:IFA<>0THEN9
48 IFJ<0ORJ>NTHENPRINT"[CRSR UP][CRSR UP]":GOTO47
49 FORI=JTON-1:IFS$(I)="[SHFT *]"ANDS$(I+1)="[SHFT *]"T
     HENI=N-1:GOTO51
50 S$(I)=S$(I+1):GOSUB65
51 NEXT:S$(N)="[SHFT *]":GOTO14
52 PRINT"[CRSR DN][CRSR DN]ALPHABETIZE  ";:GOSUB82:U=VA
     L(A$):IFU<0ORU>NTHENGOTO8
53 IFMID$(S$(U),1,1)="[CTRL 9]"THENU=U+1
54 GOSUB83:K=0:FORI=UTOKK:IFLEFT$((S$(I)),1)="[CTRL 9]"
     THENK=1:NN=I-1:I=KK
55 NEXTI:IFK=1THEN57
56 NN=KK
57 I=0
58 J=U:IFI=NN-UTHEN14
59 IFJ=NN-ITHEN62
60 IFS$(J)>S$(J+1)THENTP$=S$(J):S$(J)=S$(J+1):S$(J+1)=T
     P$
61 J=J+1:GOTO59
62 I=I+1:POKE36879,INT(RND(K)*8+184):GOTO58
63 GETA$:IFA$=""THEN63
64 RETURN
65 PRINT"[HOME]"TAB(37);I:RETURN
66 PRINT"[CRSR DN][CRSR DN][CTRL 9]ARE YOU SURE? Y/N":G
     OSUB63:RETURN
67 PRINT"[SHFT CLR][CTRL 9]HARD COPY":GOSUB66:IFA$<>"Y"
     THEN4
68 PRINT"ENTIRE FILE?":GOSUB63:IFA$="Y"THENF=0:M=N:GOTO
     71
69 GOSUB82:F=VAL(A$):IFF<0ORF>NGOTO67
70 PRINT"ENDING"R$:INPUTA$:M=VAL(A$):IFM<0ORM>NORM=<FTH
     EN67
71 OPEN4,4:A$="":FORI=1TOINT((40-LEN(T$))/2)
72 A$=A$+"[SPACE]":NEXTI:A$=A$+"[CTRL 0]":PRINT#4,CHR$(
     14)A$+T$+F$CHR$(10)CHR$(10)
73 LL=4:FORI=FTOM:IFLEFT$(S$(I),1)="[CTRL 9]"THEN76
74 IFS$(I)<>"[SHFT *]"THENPRINT#4,CHR$(15)"[5 SPACES]"S
     $(I)CHR$(10):LL=LL+2
75 GOTO79
76 A$="":FORKK=7TOLEN(S$(I))*6:A$=A$+CHR$(255):NEXTKK
77 PRINT#4,"[5 SPACES]"G$+A$:PRINT#4,F$+"[5 SPACES]"+S$
     (I)+G$
78 PRINT#4,F$+"[5 SPACES]"+G$+A$+F$CHR$(10):LL=LL+4
79 IFLL>59THENFORNL=LLTO72:PRINT#4,CHR$(10);:NEXTNL:PRI
     NT#4,"":LL=3
80 NEXTI:CLOSE4:GOTO4
81 FORJ=0TON:S$(J)="[SHFT *]":NEXTJ:RETURN
82 PRINT"STARTING"R$:INPUTA$:RETURN
83 FORI=NTO0STEP-1:IFS$(I)<>"[SHFT *]"THENKK=I:I=0:GOTO
     85
84 KK=I
85 NEXTI:RETURN
86 FORI=J+1TON:IFS$(I)="[SHFT *]"THENKK=I:I=N:GOTO85
87 KK=I
88 NEXTI:RETURN
89 FORI=NTO0STEP-1:K=I:IFS$(I)<>"[SHFT *]"THENI=0
90 NEXTI:K=K+1
91 PRINT#J,T$+" [SHFT X]":PRINT#J,K:FORI=0TOK
92 PRINT#J,S$(I):GOSUB65:NEXT:CLOSEJ:GOTO4
93 INPUT#J,N$:IFRIGHT$(N$,2)<>" [SHFT X]"THENPRINTN$" N
     OT FOUND":GOSUB63:CLOSEJ:GOTO4
94 T$=N$:T$=LEFT$(T$,LEN(T$)-2):PRINT"[CRSR DN][CTRL 9]
     FOUND "T$:INPUT#J,K
95 IFK>NTHENPRINT"[CRSR DN][CTRL 9]WARNING:":PRINT"FILE
      CAME FROM VIC WITH LARGER MEMORY":K=N
96 FORI=0TOK:INPUT#J,S$(I):GOSUB65:NEXT:CLOSEJ:GOTO4
97 PRINT"[CTRL 9][SHFT CLR]DISC FILE LISTING? [CRSR DN]
     ":GOSUB63:IFA$<>"Y"THENRETURN
98 PRINT"[SHFT CLR][CTRL 9]SCANNING DISC[CRSR DN]"
99 OPEN1,8,0,"$0"
100 GET#1,A$,B$
101 GET#1,A$,B$
```

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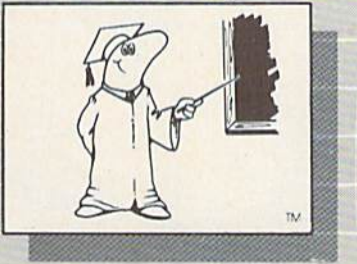

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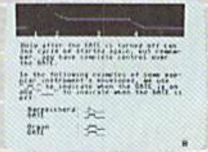

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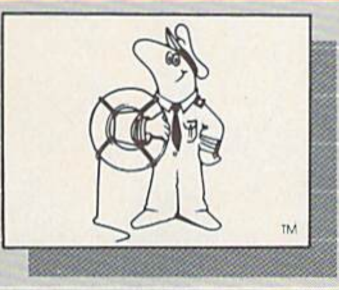
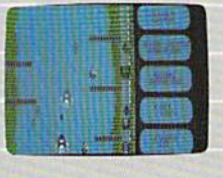
GAMES



RIVER CHASE:



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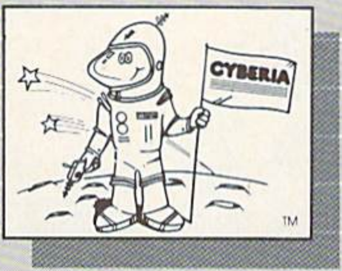

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Listing 1 continued.

```
102 GET#1,A$,B$
103 C=0
104 IF A$<>""THENC=ASC(A$)
105 IF B$<>""THENC=C+ASC(B$)*256
106 D$=D$+"[CTRL 9]"+MID$(STR$(C),2)+"[CTRL 0]"
107 GET#1,B$:IFST<>0THENCLOSE1:PRINT:RETURN
108 IF B$<>CHR$(34)THEN107
109 GET#1,B$:IF B$<>CHR$(34)THEND$=D$+B$:GOTO109
110 GET#1,B$:IFB$=CHR$(32)THEN110
111 C$=""
112 C$=C$+B$:GET#1,B$:IFB$<>""THEN112
113 IFRIGHT$(D$,1)="[SHFT X]"THENPRINTD$
114 D$="":GOTO101
115 Y=Y-1:GOTO118
116 IFLEFT$(S$(J),1)="[LEFT ARROW]"THENS$(J)="[CTRL 9]"
     +RIGHT$(S$(J),LEN(S$(J))-1)
117 GOTO14
118 FORI=0TOC:C$(I,P%(L))="[SHFT *]":NEXTI:FORI=LTOY:P%
     (I)=P%(I+1):NEXTI:L=L-1:RETURN
```

Listing 2. Deluxe File Case program for the Commodore 64.

```
10 POKE53281,14 :T$="NO NAME"
20 PRINT"[SHFT CLR][CTRL 2]FILE NAME":INPUTT$
25 PRINT"[6 CRSR DNS][14 SPACES]PLEASE WAIT":T$=LEFT$(T
     $,14)
30 N=1000:P=1:X=(N+1)/10:DIMS$(N):R$=" LINE#":GOSUB810:
     GOTO80
40 K=0
50 Q=0:PRINT"[SHFT CLR][CTRL 2][CTRL 9]CATALOG: ";T$"[C
     RSR DN][CRSR DN]":PRINT"PAGE
60 FORJ=KTON:IFASC(S$(J))=18THENPRINT"[CRSR LF]"INT(J/1
     0+1);S$(J):Q=Q+1:IFQ>10THEN80
70 NEXTJ
80 GOSUB260:IFA=0THEN80
90 ONAGOTO40,120,190,220,290,360,410,670,470,520,310
100 IFJ<N+1THENK=J:GOTO50
110 GOTO40
120 PRINT"[CRSR DN][CRSR DN]PAGE#":INPUTA$:P=VAL(A$):GO
     SUB270:IFA<>0THEN90
130 IFP<1ORP>XTHENPRINT"[3 CRSR UPS]":GOTO120
140 PRINT"[CTRL 9][SHFT CLR]PAGE"P;T$"[CRSR DN][CRSR DN
     ]":FORI=0TO9:L=(P-1)*10+I:PRINT"[CRSR LF]"L;S$(L):
     NEXT
150 GOSUB260:IFA=0THEN150
160 IFA<>12THEN90
170 P=P+1:IFP>XTHENP=1
180 GOTO140
190 A$="-1":PRINT"[CRSR DN][CRSR DN]ENTER"R$:INPUTA$:J=
     VAL(A$):GOSUB270:IFA<>0THEN90
200 IFJ<0 OR J>INT(X)*10+1THEN PRINT"[5 CRSR UPS]":GOTO
     190
210 INPUTS$(J):GOTO1160
220 A$="-1":PRINT"[CRSR DN][CRSR DN]INSERT"R$:INPUTA$:J
     =VAL(A$):GOSUB270:IFA<>0THEN90
230 IFJ<0 OR J>INT(X)*10+1THEN PRINT"[5 CRSR UPS]":GOTO
     220
240 PRINT"ENTRY":INPUTD$:PRINT"INSERTING":IFR=NTHEN140
250 GOSUB860:FORI=KKTOJ+1STEP-1:S$(I)=S$(I-1):NEXT:S$(J
     )=D$:GOTO1160
260 E$="C,P,E,I,N,S,L,H,K,A,?[CTRL 0] ":PRINTTAB(9)"[CT
     RL 9][CRSR DN]"E$"[CRSR LF][CRSR UP][CRSR UP]":GOS
     UB630
270 A=0:FORI=1TO13:IFMID$(E$,I*2-1,1)=A$THENA=I:I=13
280 NEXTI:RETURN
290 GOSUB660:IFA$<>"Y"THEN40
300 PRINT"NEW FILE NAME":INPUTT$:GOSUB810:GOTO40
310 PRINT"[SHFT CLR][CTRL 9]C[CTRL 0]ATALOG[CRSR DN]":P
     RINT"CALL [CTRL 9]P[CTRL 0]AGE[CRSR DN]":PRINT"[CT
     RL 9]I[CTRL 0]NSERT"R$
320 PRINT"[CRSR DN][CTRL 9]E[CTRL 0]NTER"R$:PRINT"[CRSR
      DN][CTRL 9]K[CTRL 0]ILL"R$:PRINT"[CRSR DN][CTRL 9
     ]A[CTRL 0]LPHABETIZE[CRSR DN]"
325 PRINT"[CTRL 9]N[CTRL 0]EW FILE[CRSR DN]"
330 PRINT"[CTRL 9]L[CTRL 0]OAD FROM TAPE OR DISC":PRINT
     "[CRSR DN][CTRL 9]S[CTRL 0]AVE TO TAPE OR DISC[CRS
     R DN]"
340 PRINT"[CTRL 9]?[CTRL 0] DEFINITIONS":PRINT"[CRSR DN
     ][CTRL 9]H[CTRL 0] LIST TO PRINTER[CRSR UP]":GOSUB
     260:IFA=0THEN310
350 GOTO90
360 PRINT"[SHFT CLR][CTRL 1]SAVE TO TAPE OR DISC":GOSUB
     660:IFA$<>"Y"THEN40
370 PRINT"[CTRL 9]D[CTRL 0]ISC OR [CTRL 9]T[CTRL 0]APE?
     ":GOSUB630:IFA$="T"THEN400
380 IFA$<>"D"THEN40
390 OPEN2,8,2,"@0:"+T$+"[SPACE][SHFT X],S,W": J=2 :GOTO
     890
400 OPEN1,1,1,T$:PRINT#1,T$:J=1:GOTO890
410 PRINT"[SHFT CLR][CTRL 9]LOAD FROM TAPE OR DISC":GOS
     UB660:IFA$<>"Y"THEN40
420 PRINT"[CTRL 9]D[CTRL 0]ISC OR [CTRL 9]T[CTRL 0]APE?
     ":GOSUB630:IFA$="T"THEN460
430 IFA$<>"D"THEN40
440 GOSUB970:PRINT"[CRSR DN]FILE NAME?":INPUTN$:IFN$=""
```

More →

Listing 2 continued.

```
    THEN40
450 OPEN2,8,2,"0:"+N$+"[SPACE][SHFT X],S,R": J=2 : GOTO
     930
460 OPEN1,1,0:J=1:GOTO930
470 PRINT"[CRSR DN][CRSR DN]KILL"R$:INPUTA$:J=VAL(A$):G
     OSUB270:IFA<>0THEN90
480 IFJ<0ORJ>NTHENPRINT"[CRSR UP][CRSR UP]":GOTO470

500 S$(I)=S$(I+1):GOSUB650
510 NEXT:S$(N)="[SHFT *]":GOTO140
520 PRINT"[CRSR DN][CRSR DN]ALPHABETIZE  ";:GOSUB820:U=
     VAL(A$):IFU<0 OR U>NTHENGOTO80
530 IFMID$(S$(U),1,1)="[CTRL 9]"THENU=U+1
540 GOSUB830:K=0:FORI=UTOKK:IFLEFT$((S$(I)),1)="[CTRL 9
     ]"THENK=1:NN=I-1:I=KK
550 NEXTI:IFK=1THEN570
560 NN=KK
570 I=0
580 J=U:IFI=NN-UTHEN140
590 IFJ=NN-ITHEN620

600 IFS$(J)>S$(J+1)THENTP$=S$(J):S$(J)=S$(J+1):S$(J+1)=
     TP$
610 J=J+1:GOTO590
620 I=I+1:POKE53280,INT(RND(K)*15+1):GOTO580
630 GETA$:IFA$=""THEN630
640 RETURN
650 PRINT"[HOME]"TAB(30);I:RETURN
660 PRINT"[CRSR DN][CRSR DN][CTRL 9]ARE YOU SURE? Y/N":
     GOSUB630:RETURN
670 PRINT"[SHFT CLR][CTRL 9]HARD COPY":GOSUB660:IFA$<>"
     Y"THEN40
680 PRINT"ENTIRE FILE?":GOSUB630:IFA$="Y"THENF=0:M=N:GO
     TO710
690 GOSUB820:F=VAL(A$):IFF<0 OR F>NGOTO670

700 PRINT"ENDING"R$:INPUTA$:M=VAL(A$):IFM<0 OR M>N OR M
     =<F THEN670
710 OPEN4,4:A$="":FORI=1TOINT((40-LEN(T$))/2)
720 A$=A$+"[SPACE]":NEXTI:A$=A$+"[CTRL 0]":PRINT#4,CHR$
     (14)A$+T$+F$CHR$(10)CHR$(10)
730 LL=4:FORI=KTON:IFLEFT$(S$(I),1)="[CTRL 9]"THEN760
740 IFS$(I)<>"[SHFT *]"THENPRINT#4,CHR$(15)"[5 SPACES]"
     S$(I)CHR$(10):LL=LL+2
750 GOTO790
760 A$="":FORKK=7TOLEN(S$(I))*6:A$=A$+CHR$(255):NEXTKK
770 PRINT#4,"[5 SPACES]"G$+A$:PRINT#4,F$+"[5 SPACES]"+S
     $(I)+G$
780 PRINT#4,F$+"[5 SPACES]"+G$+A$+F$CHR$(10):LL=LL+4
790 IFLL>59THENFORNL=LLTO72:PRINT#4,CHR$(10);:NEXTNL:PR
     INT#4,"":LL=3
```

```
800 NEXTI:CLOSE4:GOTO40
810 FORJ=0TON:S$(J)="[SHFT *]":NEXTJ:RETURN
820 PRINT"STARTING"R$:INPUTA$:RETURN
830 FORI=NTO0STEP-1:IFS$(I)<>"[SHFT *]"THENKK=I:I=0:GOT
     O850
840 KK=I
850 NEXTI:RETURN
860 FORI=J+1TON:IFS$(I)="[SHFT *]"THENKK=I:I=N:GOTO850
870 KK=I
880 NEXTI:RETURN
890 FORI=NTO0STEP-1:K=I:IFS$(I)<>"[SHFT *]"THENI=0

900 NEXTI:K=K+1
910 PRINT#J,T$+"[SPACE][SHFT X]":PRINT#J,K:FORI=0TOK
920 PRINT#J,S$(I):GOSUB650:NEXT:CLOSEJ:GOTO40
930 INPUT#J,N$
935 IFRIGHT$(N$,2)<>"[SPACE][SHFT X]"THENPRINTN$" NOT F
     OUND":GOSUB630:CLOSEJ:GOTO40
940 T$=N$:T$=LEFT$(T$,LEN(T$)-2):PRINT"[CRSR DN][CTRL 9
     ]FOUND "T$:INPUT#J,K
950 IFK>NTHENPRINT"[CRSR DN][CTRL 9]WARNING:":PRINT"FIL
     E CAME FROM VIC WITH LARGER MEMORY":K=N
960 FORI=0 TO K:INPUT#J,S$(I):GOSUB650:NEXT:CLOSEJ:GOTO
     40
970 PRINT"[CTRL 9][SHFT CLR]DISC FILE LISTING? [CRSR DN
     ]":GOSUB630:IFA$<>"Y"THENRETURN
980 PRINT"[SHFT CLR][CTRL 9]SCANNING DISC[CRSR DN]"
990 OPEN1,8,0,"$0"

1000 GET#1,A$,B$
1010 GET#1,A$,B$
1020 GET#1,A$,B$
1030 C=0
1040 IF A$<>""THENC=ASC(A$)
1050 IF B$<>""THENC=C+ASC(B$)*256
1060 D$=D$+"[CTRL 9]"+MID$(STR$(C),2)+"[CTRL 0]"
1070 GET#1,B$:IFST<>0THENCLOSE1:PRINT:RETURN
1080 IF B$<>CHR$(34)THEN1070
1090 GET#1,B$:IF B$<>CHR$(34)THEND$=D$+B$:GOTO1090
1100 GET#1,B$:IFB$=CHR$(32)THEN1100
1110 C$=""
1120 C$=C$+B$:GET#1,B$:IFB$<>""THEN1120
1130 IFRIGHT$(D$,1)="[SHFT X]"THENPRINTD$
1140 D$="":GOTO1010
1150 Y=Y-1:FORI=0TOC:C$(I,P%(L))="[SHFT *]":NEXTI:FORI=
      LTOY:P%(I)=P%(I+1):NEXTI
1155 L=L-1:RETURN
1160 IFLEFT$(S$(J),1)="[LEFT ARROW]"THENS$(J)="[CTRL 9]
      "+RIGHT$(S$(J),LEN(S$(J))-1)
1170 GOTO140
```

Circle 47 on Reader Service card.

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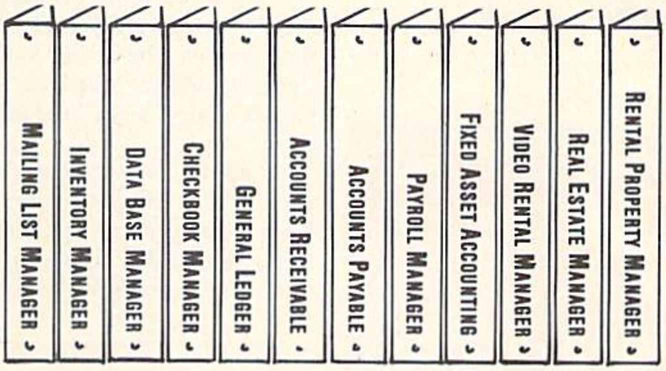
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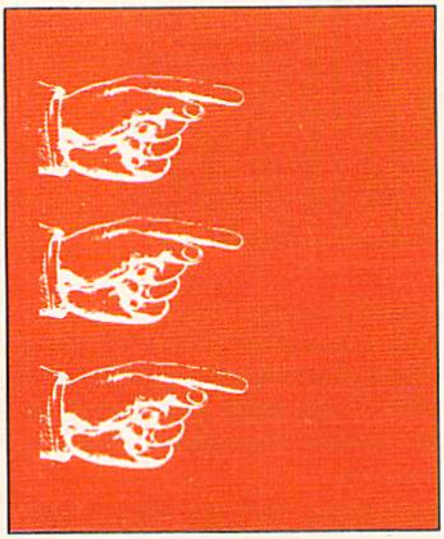
By Joe Rocke



RUN It Right

Unexpanded VIC-20

Address author correspondence to Joe W. Rocke, 224 W. Benson St., Ridgecrest, CA 93555.

This game stems from memories of the good old days, when you'd find a "shootin' gallery" at nearly every amusement park, circus or traveling sideshow. Ah! Those traveling carnivals bring back fond memories of talking dogs and dancing frogs; of plenty of 5-cent ice cream cones (the homemade kind), balloons, and here and there a few baboons, some of whom lived in the town. Pretty girls aside, the real attraction for the local lads was the shooting gallery. "Show the li'l gal how you can shoot, boys," the barker would coax.

Of course, only the carnies knew that the powder charge in the cartridges would barely carry the bullets to the target. For added insurance, the targets were weighted so it would take a cannon to blow them over.

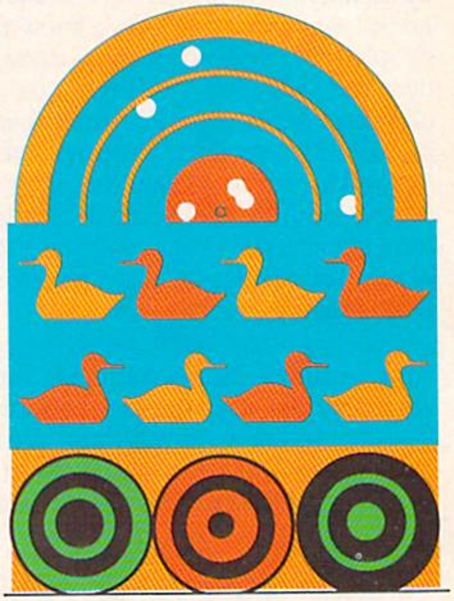
When a carnie managed to make a side bet with one of the locals, the carnie's rifle was loaded with special ammo. After closing hours and a round of cards, the winnings would be split with the gallery manager. Those were the good old days, when you learned the tricks of the trade through first-hand experience!

The VIC Gallery

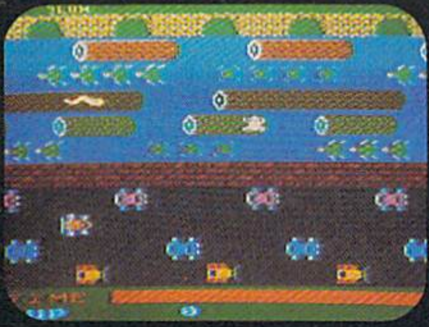
But those days are gone, and games of chance have now become computerized. Like their predecessors, some of these have been rigged, too. In the VIC Gallery, you have dual laser cannons instead of the .22 rifle of the past. Action is controlled by a single trigger, which in this case is the joystick button or the keyboard space bar.

Color was an important feature of the early carnival games, so this one also makes use of color. Sound was not important in those days, for no one could hear anything over the hawker's call to buy snake oil or "genuine" diamonds made of the very best leaded glass. So sit back and grab a Cracker Jack while we take a tour of the VIC Gallery.

The program is divided into two modules so that it can run on an unexpanded VIC. The data module (Listing 1) Pokes the custom graphics data to memory, sets memory protect and provides the autoload instructions.



The foregoing operations are performed in lines 10 through 40. Line 50 invokes an autoload operation that loads the game module when the data module is run. The remaining lines contain the data that provides the custom graphics and the display screen. You must use the shift key when typing in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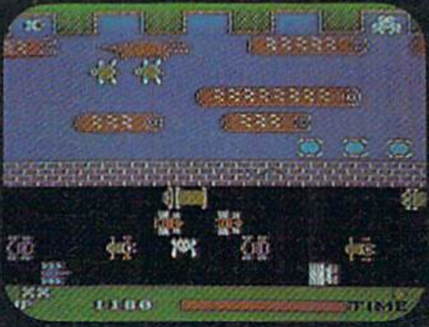
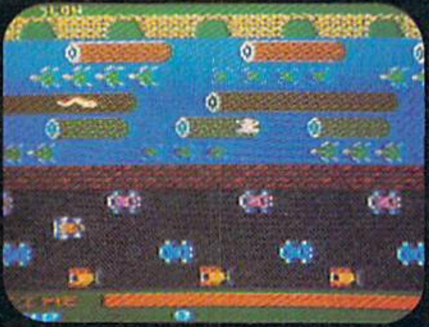
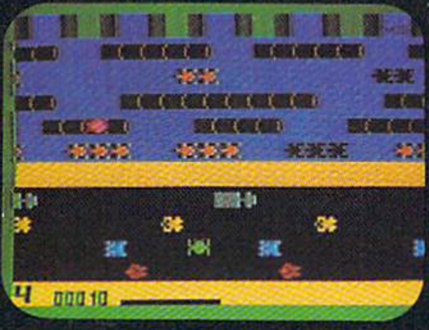
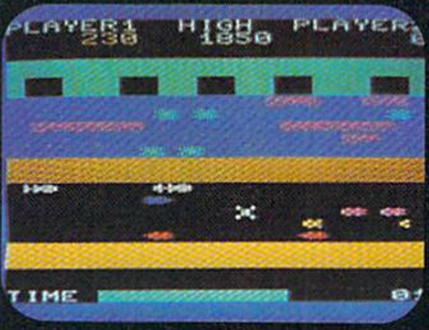
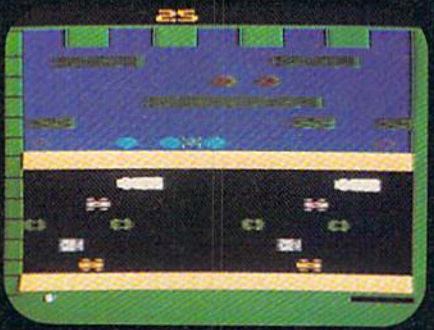

TI99/4A

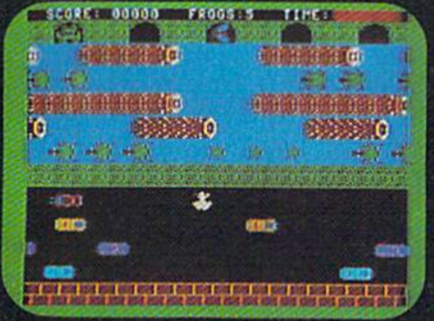

ATARI 400/800/600XL


INTELLIVISION

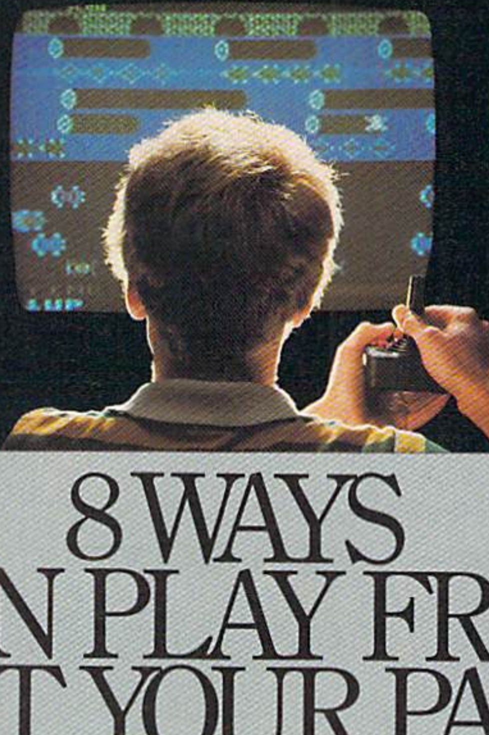


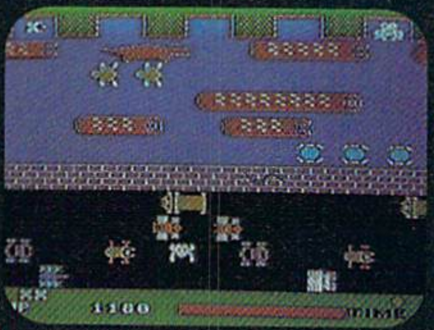
COMMODORE VIC 20


ATARI 2600



COMMODORE 64

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Circle 10 on Reader Service card.

Listing 1. VIC Gallery program for the unexpanded VIC-20.

```
1 REM  VIC GALLERY
2 REM  DATA MODULE
3 REM      FOR
4 REM CUSTOM GRAPHICS
5 REM
6 REM       BY
7 REM    JOE ROCKE
8 REM
10 POKE51,0:POKE52,28:POKE55,0:POKE56,28:CLR:GOSUB150
20 FORM=256TO274:READD:POKEM,D:A=A+D:NEXT
30 SYS256
40 FORM=7432TO7551:READD:A=A+D:POKEM,D:NEXT
45 IFA<>12326THENPRINT"[CTRL 9] ERROR IN YOUR DATA ":EN
     D
50 POKE198,5:POKE631,78:POKE632,69:POKE633,87:POKE634,1
     3:POKE635,131:END
60 DATA 162,.,189,.,128,157,.,28,189,.,129,157,.,29,232
     ,208,241,96,.
70 DATA 16,24,20,26,21,251,245,255,.,.,.,.,.,.,.,255,255,25
     5
80 DATA 8,24,40,88,168,216,175,255,126,102,90,90,90,90,
     102,126
90 DATA 90,60,90,126,102,36,60,24,160,160,128,128,160,1
     79,128,255
100 DATA 5,5,1,1,5,205,1,255,255,128,179,160,128,128,16
     0,160
110 DATA 255,1,205,1,1,1,5,5,1,2,.,8,16,.,64,128
120 DATA 128,64,.,16,8,.,2,1,40,129,36,18,64,10,64,17
130 DATA 153,51,102,204,153,51,102,204,90,.,60,90,90,60
     ,.,90
140 DATA 102,66,24,66,66,24,66,102
150 POKE36869,242:POKE36879,125:PRINT"[SHFT CLR][CRSR D
     N]"SPC(2)"[CTRL 3][CTRL 9][18 SPACES][CTRL 0]"
160 PRINTSPC(2)"[CTRL 9] SHOOTING GALLERY [CTRL 0]":PRI
     NTSPC(2)"[CTRL 9][18 SPACES][CTRL 0]"
170 PRINT"[CRSR DN]"SPC(3)"[CTRL 2]BY: [SHFT J]OE [SHFT
     W]. [SHFT R]OCKE"
180 PRINT"[CRSR DN][CRSR DN]"SPC(5)"[CTRL 1]LOADING DAT
     A"
190 PRINT"[CRSR DN]"SPC(2)"[SHFT P]ROGRAM [SHFT A]UTO [
     SHFT L]OADS[CRSR UP][CTRL 8]":RETURN


1 REM   VIC GALLERY
2 REM   GAME MODULE
3 REM       BY
4 REM    JOE ROCKE
5 REM
6 REM
10 POKE51,.:POKE52,28:POKE55,.:POKE56,28:POKE36879,15:P
     RINT"[SHFT CLR]"
20 TS=700:SH=500:R=28:T=10100:DEF FNS(A)=(TS+HI+SH-(5*R
     )):GOTO410
30 POKE36869,255:POKE36874,128:POKE36879,110:C=30720:TX
     =7911:A=.
40 FORN=7966TO8053:POKEN+C,5:NEXT:FORN=8010TO8075:POKEN
     +C,4:NEXT
50 PRINT"[HOME][CTRL 2]   SHOOTING GALLERY":PRINT"[CRSR
      DN]";N$
60 PRINT"[5 CRSR DNS]"SPC(9)"([SPACE][SPACE])[3 CRSR DN
     S]"SPC(18)"&[SPACE][SPACE]'"
65 FORN=1TO5:PRINT:NEXT
70 PRINT"[CTRL 8][SPACE]!";:FORN=1TO18:PRINTCHR$(34);:N
     EXT:PRINT"#"
80 PRINT"[CRSR DN][CRSR DN][CTRL 8][SPACE]TIME[4 SPACES
     ]SCORE[2 SPACES]SHOTS"
90 GOSUB550:IFFBGOTO120
100 IFP=32GOTO120
110 U=V:GOTO280
120 SH=SH-2:POKE36878,15:S=FNS(.):IFSH<.GOTO380
130 FORN=1TO8:POKE(8077-(N*21)),42:POKE(8096-(N*23)),43
     :POKE36876,(16*N)+127
```

More →

the graphics symbols in lines 160–180. These will appear as lowercase characters in the display screen.

No, the periods you see in the Data statements of the listing are not mistakes. The period is used in place of zero (0), as this helps speed up the game a bit. You see, the VIC has a few carnie type tricks of its own!

The data module listing is displaced when the game module autoloads. The displacement frees the memory space formerly occupied by the data module listing. As the data is in a protected memory area, it is not lost when the game module is loaded and run.

The Game Module

The game module provides the header and playing screens, the action and sound. Lines 10–30 reset the VIC pointers, define the major variables and provide the Pokes to access the custom graphics. Line 40 then overlays the RAM characters with the preprogrammed graphics. Note that a period has been used in line 10 in place of a zero.

This is a good place to point something out. A PRINT FRE(0) will show about 500 bytes of free memory. Great! That must leave lots of room for more flashing lights of the old-time carnival. Sorry, my friend, that is a non-truth. (Old-time carnie managers never told lies, only non-truths.)

When the program is run, many strings and variables are created, and the VIC has to have work room to do its chores. The work area lies between the end of the Basic program and the protected memory. A program such as this requires about 500+ bytes of free work space for the VIC to do its thing.

Lines 50–80 set up the game screen header and title blocks used in the game. Line 90 then sends control to a subroutine to check for the joystick fire button.

Lines 100–210 do a multitude of tasks. They check the keyboard and joystick, and they control the lasers, the sound and the branches to various subroutines.

Lines 220–280 continue to check the keyboard and joystick, replace targets and divide the strings into the correct number of targets—in case any are actually hit.

Lines 290–300 check the various strings, the time, the number of shots and the difficulty level. Targets are also replaced if you miss or shoot at a blank space. The display of targets, time, score and remaining shots is controlled in this group of lines.

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Listing 1 continued.

```
140 NEXT:POKE36876,128:FORN=1TO8
150 POKE(8077-(N*21)),32:POKE(8096-(N*23)),32:NEXT:POKE
     36878,.:GOTO180
160 POKE36878,15:POKE36874,.:FORN=1TO6:FORM=200TO220+N:
     POKE36876,M:NEXT:NEXT
170 POKE36876,128:GOTO90
180 P=PEEK(TX):IFP=32GOTO240
190 IFP=360RP=37GOTO650
200 IFP=460RP=47GOTO650
210 IFP=44GOTO240
220 B$=LEFT$(A$,14):C$=CHR$(32):D$=RIGHT$(A$,15):A$=B$+
     C$+D$:R=R-1
225 IFR=.ORR=-1GOTO360
230 FORN=1TO15:POKE36879,42:NEXT:POKE36879,110:GOTO90
240 IFA=.GOTO260
250 A$=E$:A=.:GOTO270
260 A$=F$:A=1
270 R=28:S=FNS(.):GOTO160
280 B$=RIGHT$(A$,28):POKE36874,128:POKE36874,135:POKE36
     878,.:D$=LEFT$(A$,2)
290 A$=B$+D$:PRINT"[HOME]":FORN=1TO9:PRINT:NEXT:PRINTA$
     :T=T+1:IFT>10350GOTO340
300 S=FNS(.):S$="[SPACE]":IFS<1000THENS$=S$+"[SPACE]"
310 PRINTSPC(176)"[CTRL 6]":T;S$;S;"[SPACE]";SH"[CTRL 2
     ]"
320 U=U-1:IFU=.GOTO90
330 IFU>0GOTO280
340 GOSUB400:PRINT"[CRSR DN][CRSR DN][CRSR DN][CTRL 1]"
     SPC(4)"[SHFT T]IME [SHFT R]AN OUT!!":PRINT"[CRSR D
     N][CRSR DN] [SHFT Y]OUR [SHFT S]CORE [SHFT W]AS";
350 PRINTFNS(.):PRINT"[CRSR DN][CRSR DN][CTRL 5][SHFT A
     ]NOTHER [SHFT Q]UARTER [SHFT P]LEASE":E=.:GOTO560
360 GOSUB400:S=FNS(.)+1000:PRINT"[CRSR DN][CRSR DN][CRS
     R DN][CTRL 1]"SPC(4)"[SHFT G]OO[SHFT D] [SHFT S]HO
     OTIN!!"
365 PRINT"[CRSR DN][CRSR DN] [SHFT Y]OUR [SHFT S]CORE [
     SHFT W]AS";
370 PRINTS:PRINT"[CRSR DN][CTRL 5] [SHFT B]ONUS=1000":P
     RINT"[CRSR DN][CRSR DN][CTRL 3] [SHFT Y]OU [SHFT W
     ]IN A [SHFT T]EDDY [SHFT B]EAR":E=1:GOTO560
380 GOSUB400:PRINT"[CRSR DN][CRSR DN][CRSR DN][CTRL 1]"
     SPC(4)"OUT OF [SHFT S]HOTS!!":PRINT"[CRSR DN][CRSR
      DN] [SHFT Y]OUR [SHFT S]CORE [SHFT W]AS";
390 PRINTFNS(.):PRINT"[CRSR DN][CTRL 5][SHFT A]NOTHER [
     SHFT Q]UARTER [SHFT P]LEASE":E=.:GOTO560
400 POKE36869,242:POKE36879,122:PRINT"[SHFT CLR]":RETUR
     N
410 POKE36869,242:PRINT"[SHFT CLR][CRSR DN][CRSR DN][CT
     RL 8][SPACE][SPACE][CTRL 9][18 SPACES][CTRL 0]":PR
     INT"[SPACE][SPACE][CTRL 9][SPACE]SHOOTING GALLERY[
     SPACE][CTRL 0]"
420 PRINT"[SPACE][SPACE][CTRL 9][18 SPACES][CTRL 0][CRS
     R DN]":PRINT"[CTRL 4][3 SPACES]BY: [SHFT J]OE [SHF
     T W]. [SHFT R]OCKE"
430 PRINT"[CRSR DN][CRSR DN][CTRL 5][3 SPACES][SHFT S]E
     LECT [SHFT D]IFFICULTY[CRSR DN]":PRINTSPC(4)"1 [SH
     FT E]ASY - 6 [SHFT H]ARD"
440 GETA$:GOSUB660
450 V=VAL(A$):IFV<10RV>6THEN440
460 PRINT"[CRSR DN][CTRL 8][SPACE][SPACE][SPACE]";V:PRI
     NT"[CRSR DN][CRSR DN][CTRL 2][SHFT P]RESS [SHFT A]
     [SHFT N][SHFT Y] [SHFT K]EY TO [SHFT S]TART"
470 GOSUB550:IFFBGOTO510
480 GOSUB660
490 IFP=32GOTO510
500 GETA$:IFA$=""GOTO470
510 A$=" [CTRL 5].[CTRL 4]$$.[CTRL 8]$$.[CTRL 6]$$ [CTR
     L 1]$$.[CTRL 5]$$.[CTRL 6]$$.[CTRL 2]$$"
520 F$=" [CTRL 5]/[CTRL 4]%%/[CTRL 8]%%/[CTRL 6]%% [CTR
     L 1]%%/[CTRL 5]%%/[CTRL 6]%%/[CTRL 2]%%"
530 N$="[CTRL 6] --[CTRL 5]---[CTRL 4]---[CTRL 8]---[CT
     RL 4]---[CTRL 5]---[CTRL 6]-- [CTRL 5]"
```

More

Lines 310–400 are used to present your sharpshooter rewards and to find out if you wish to play again. Here again, you must use the shift key to type in the messages, as they are displayed in lowercase.

Lines 410–490 look a heck of a lot like the beginning of the game, which is what they are. Quite often a programmer will write the startup routine after the main part of the game is complete. In developing a program for the unexpanded VIC, this will most likely be a subroutine tacked into an open spot in the program.

A GOTO command will work just as fast as if the startup routine were the first line of the program, so its actual location is not all that important. Inserting the routine later in the program is one way to find out if the remaining memory will allow you to be fancy in setting up the header screen.

Lines 510–540 set the initial strings of programmed targets. Line 550 checks the keyboard and fire button of the joystick. This is used many, many times as a subroutine.

Lines 560–640 are response loops, to find out if you wish to play or quit, and to make sure the high score is recorded for those who outwit the "manager." These lines will also return to the difficulty level, so you can pick a new level if so inclined.

Part of the "rigging" is that I fooled around with the laser trigger so that a bunch of targets will pass by before the trigger responds to your input. Thus, the response will no longer be hair trigger, as it is in the Level 1 mode.

Line 650 reveals a seldom-used trick. The VIC manual states that you have your choice of eight colors that can be Poked to the color screen. What happened to the ones from 9 to 255? All single addresses from 0 to 255 can be Poked. If you look closely at the display when a target is hit, you'll see it appear to explode in many colors. While it's not the intent of this article to get involved with bits of a byte, you'll find that line 650 Pokes color 22 to the color screen. If you wish to experiment, you can try numbers within the range of 0 to 255 for different results.

Lines 660–670 provide the subroutine that Pokes the colors to the header screen SHOOTING GALLERY banner. When you run the program, you'll note that the colors move in opposite directions for each word of the banner. The left-to-right color movement in the word GALLERY is performed by line 670. This is done by using a reverse counting loop, incrementing the count

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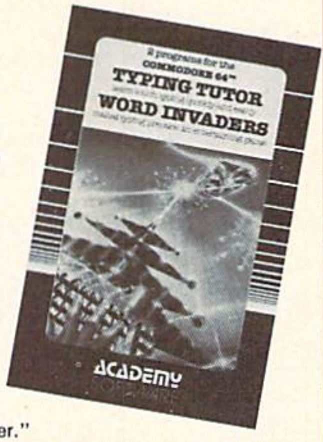

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Listing 1 continued.

```
540 PRINT"[SHFT CLR]":E$=A$:GOTO30
550 POKE37137,62:FB=-((PEEK(37137)AND32)=.):P=PEEK(197)
     :RETURN
560 PRINT"[CRSR DN][CRSR DN][CRSR DN][CTRL 2]"SPC(4)"[C
     TRL 9][SHFT T]RY [SHFT A]GAIN ([SHFT Y]/[SHFT N])"
570 GETA$:IFA$=""THEN570
580 IFA$="Y"GOTO620
590 IFA$="N"GOTO610
600 GOTO570
610 POKE36869,240:POKE36879,27:PRINT"[SHFT CLR]":END
620 IFE=1THENHI=S-1000
630 IFE=.THENHI=.
640 POKE36879,15:GOTO20
650 FORN=1TO20:POKETX,44:POKETX-1,44:POKETX+C,22:POKETX
     -1+C,22:NEXT:GOTO210
660 FORN=38469TO38476:POKEN,INT(7*RND(1)+1):NEXT
670 FORN=38484TO38478STEP-1:POKEN,INT(7*RND(1)+1):NEXT:
     RETURN
```

by STEP −1.

Loading the Program

Of course you're eager to run the program after typing it in, but be sure to save each module to tape before running it. Then, if you have a typo in the listing that would cause the program to crash, your initial efforts will not be lost. All too often a typo locks up the keyboard, making it necessary to power down to recover control.

There is no easy way to check a typo in the data module until you run the program. If you do wish to check it first, make line 50 a REM line to lock out the autoload feature. Then run the listing. If there is no indication of a data error, type POKE 36869,255 from the Command mode (i.e., no line number).

This will switch the VIC to the graphics mode, and messages on the screen will be garbage. Try typing the period, $, % and '–' keys; you should see custom characters. These keys are used in lines 510–530 of the game module to provide the targets. To recover control, type POKE 36869, 240. You will have to type this "blind," as only programmed keys provide legible characters.

After both modules have been debugged, the normal loading procedure will be as follows. Load and run the Data module. Leave the Datassette play key depressed. The Data module will automatically load and run the Game module. The header screen will automatically appear when the loading operation is completed.

The Sucker Bet

Step right up and hit the bull's eye, pardner! Who needs instructions to pull the trigger? Rather, press the space bar or firebutton. But don't fall for a sucker bet as to your marksmanship! The targets are rigged, and what looks like two may be only one!

Shooting at a blank space will replace all the targets, and the score will go down. If you try a double shot at the

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The target you see might not really be there!

same target, it is no longer there, so you are really shooting at a blank space. But it's not fair to keep you good VIC gamesters in the dark as to the rigging, so here's a small tip: keep your eye on the right hand target!

The only target that can be hit is the one that enters the shooting grid on the very right hand side. The one to the left appears to be a target, but is really a space. What you see is not always what's really there! This apparent illusion is a trick in programming, as opposed to the use of mirrors in some arcade games.

To explain the last statement, take a close look at the games in a modern arcade. Mirrors are often used to create a three-dimensional effect, giving the impression that more action is taking place than there really is.

Peek straight down, to the left and right, and straight up into the video game. Parts of the object displayed are passed through colored filters, then to a mirror or prism before being reflected back to the eye with a leaded glass. The total effect is an illusion of the fast action that has become the trademark of video games.

The VIC Timer

What about the game timer, you ask? Well, TI$ was too slow to give the desired effect, so the time is faked. (You didn't expect a carnival-type game to be honest, did you?) On the VIC, TI has a different value than TI$. To check this, try the following:

```
10 TI$ = "000000"
20 PRINT TI, TI$
30 GOTO 20
```

Or change line 30 to FOR X=1 TO 500: NEXT: GOTO 20

Adding the delay loop slows the above test program to the point where you begin to see there is some relation between the two counters. The loop will add about half a second on the VIC, so the seconds are usually displayed twice. This is why I faked the timer, for it has to run much faster than one second. This was necessary to keep the score and the shots in the correct position on the screen.

The action in VIC Gallery is surprisingly fast for a Basic program. Level 6 is not the hardest, but levels 2 and 3 are pretty tricky. In level 1, you can rack up 100K points. So good shootin', pardner! Ⓡ

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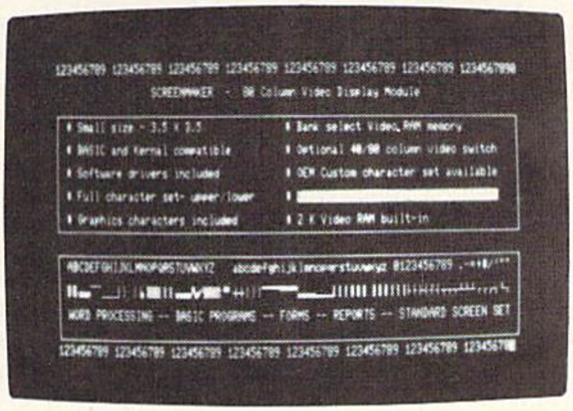

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A Taste of Arrays

If you're hungry to know what arrays are and what they can do for your programs, here's a clear, step-by-step tutorial to chew on.

By Sharon Zardetto Aker

RUN It Right
Commodore 64

Address author correspondence to Sharon Zardetto Aker, 20 Courtland Drive, Sussex, NJ 07461.

The most often asked question about arrays, after "What *are* they?" is "What are they *for*?" At first, they may seem like just another type of variable; but read on, and discover some of the uses of this powerful programming technique.

What Is an Array?

With arrays you can store information. When that information consists of numbers, a numeric array is used; a string array is used for character-string storage.

You can think of an array as a row of empty boxes, each able to hold any number or string you want to put into it. Each box has a name, made up of the variable that names the whole row, plus a number that indicates the box's position in the row. If you have a row of five boxes, they might be called:

```
A(0) A(1) A(2) A(3) A(4)
```

The number in parentheses is called a subscript; A(1) is pronounced "A sub-one."

Dimensioning an array means telling the computer to set aside a block of memory cells to store information. That information might be given within the program itself, or it might be input while the program is running.

To dimension an array, use the Dim statement: DIM A(20). This tells the computer to set aside 21 memory cells, or elements, the first being A(0), the last A(20).

The computer automatically dimensions an array of eleven elements if—without employing the Dim statement—you use a subscripted variable within a program. For example, if you use 30 A(4) = 17, the computer will dimension an array named A, with the eleven elements A(0) through A(10). This automatic dimensioning occurs, however, only if your subscript is ten or less. To use higher subscripts, you *must* use the Dim statement first.

It is good programming practice always to dimension an array, regardless of its size; your listing will be much easier to follow. It can also be a memory-saver: although it adds a line to your program, DIM A(4) will dimension an array of only five elements, instead of the automatic eleven.

Any numeric variable such as A%(4), BP(8) or XL(10) can be used to name a numeric array. Any legal string variable like A$(9) or SZ$(8) can be used for a string array.

It is sometimes confusing, and often inconvenient, that the Commodore identifies the first element of an array as "0." Keep in mind that "DIM A(5)" gives you *six* elements, A(0) through A(5), not five elements, A(1) through A(5).

Filling an Array

To fill one of the "boxes" in an array when writing a program, you assign it a value just as you'd assign a value to any other variable:

```
A(2)=17:A(4)=8
```

or

```
FOR X=1 TO 3:READ A(X):NEXT
DATA 5,17,83
```

The subscripted variable that stands for a cell in an array can be used like any other variable. For instance, A(1) = A(1) + 1, PRINT A(3) and PRINT A(4)*16 are all valid commands.

To fill a box during the running of a program, all you have to do is use the name of the element with the Input command, like this: INPUT A(4) or INPUT B(6).

Try this short program:

```
10 DIM A(2)
20 A(0)=15:A(1)=27:A(2)=32
30 FOR N=0 TO 2:PRINT A(N): NEXT
```

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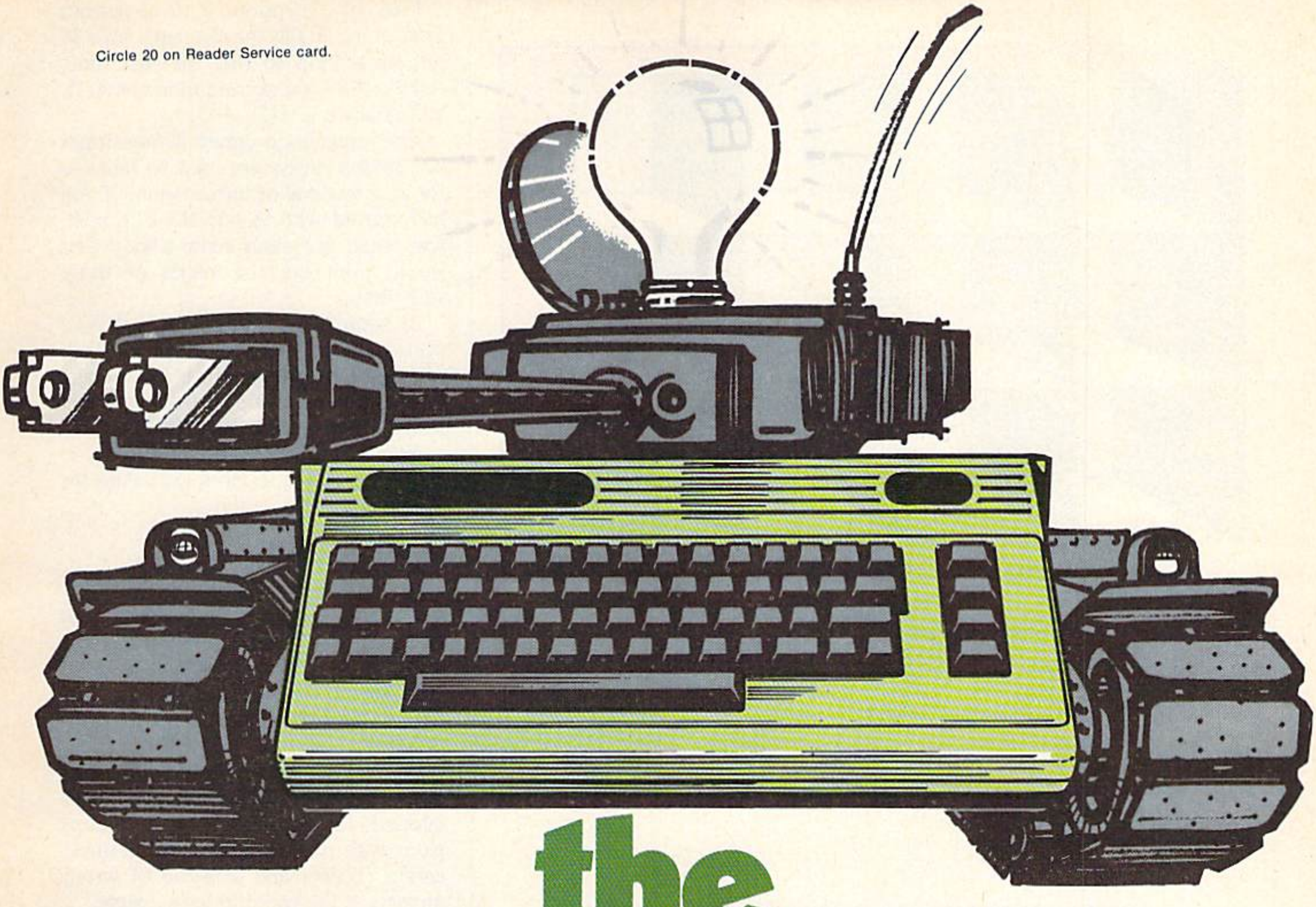

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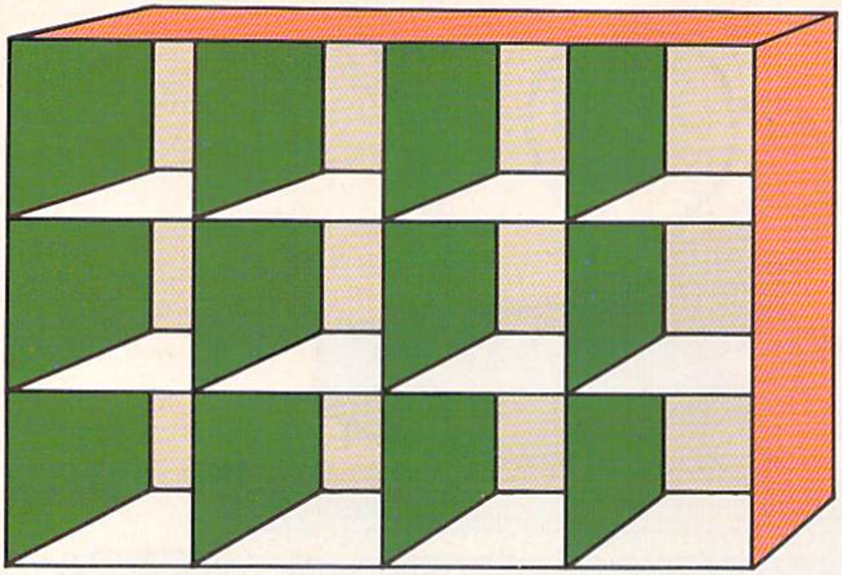


Fig. 1. A stack-of-boxes analogy for a two-dimensional array.

```
10 DIM A(5)
15 FOR N=0 TO 5
20 PRINT"WHAT DO YOU WANT IN BOX"N
25 INPUT A(N):NEXT N
30 FOR N=0 TO 5
35 PRINT"BOX"N"CONTAINS"A(N)
```

Listing 1. A program for inserting values into an array.

```
10 N=INT(RND(0)*50)+1
20 FOR T=1 TO 20
30 INPUT"WHAT'S YOUR GUESS";G
40 IF G=N THEN PRINT"YOU WIN!":END
50 NEXTT
60 PRINT"YOU LOSE. THE NUMBER WAS"N:END
```

Listing 2. A no-frills version of the number-guessing game.

```
10 DIM A(19)
20 N=INT(RND(0)*50)+1
30 FOR T=0TO19
40 INPUT"WHAT'S YOUR GUESS";G
50 FOR CK=0TOT
60 IFG=A(CK)THEN PRINT"YOU TRIED THAT ALREADY":GOTO40
70 IFG<>A(CK)THEN NEXT CK
80 LETA(T)=G
90 IFG=NTHENPRINT"YOU WIN":GOTO120
100 NEXTT
110 PRINT"YOU LOSE. THE NUMBER WAS"N
120 PRINT"YOUR GUESSES WERE:":PRINT
130 FORX=0TO19:PRINTA(X),:NEXTX:END
```

Listing 3. The number-guessing game with added features.

Line 10 dimensions a three-element array. Line 20 fills the elements. Line 30 sets up a loop so that the first time, A(N) is A(0), the second time it is A(1), and finally it is A(2).

The foregoing program demonstrates one reason arrays are used so much—for easy retrieval of information. If you had started with A = 15:B = 27:C = 32, you could not easily write a loop that would print out the values of those variables.

As soon as a numeric array is dimensioned, by the way, the computer fills it with zeros, so an element is never really empty. The cells of a just-dimensioned string array contain empty strings.

Now try the program in Listing 1, which allows you to input the values for the array.

Applying Arrays

You may be familiar with simple number guessing games, where the computer generates a random number that you must guess. Listing 2 is a no-frills version of that game: you have 20 tries to find the number, which is between one and fifty.

An array is a perfect way of keeping track of which numbers you've already guessed. Listing 3 is the same guessing game with two extra features—a duplication checker and a re-cap of wrong answers at the end of a losing game.

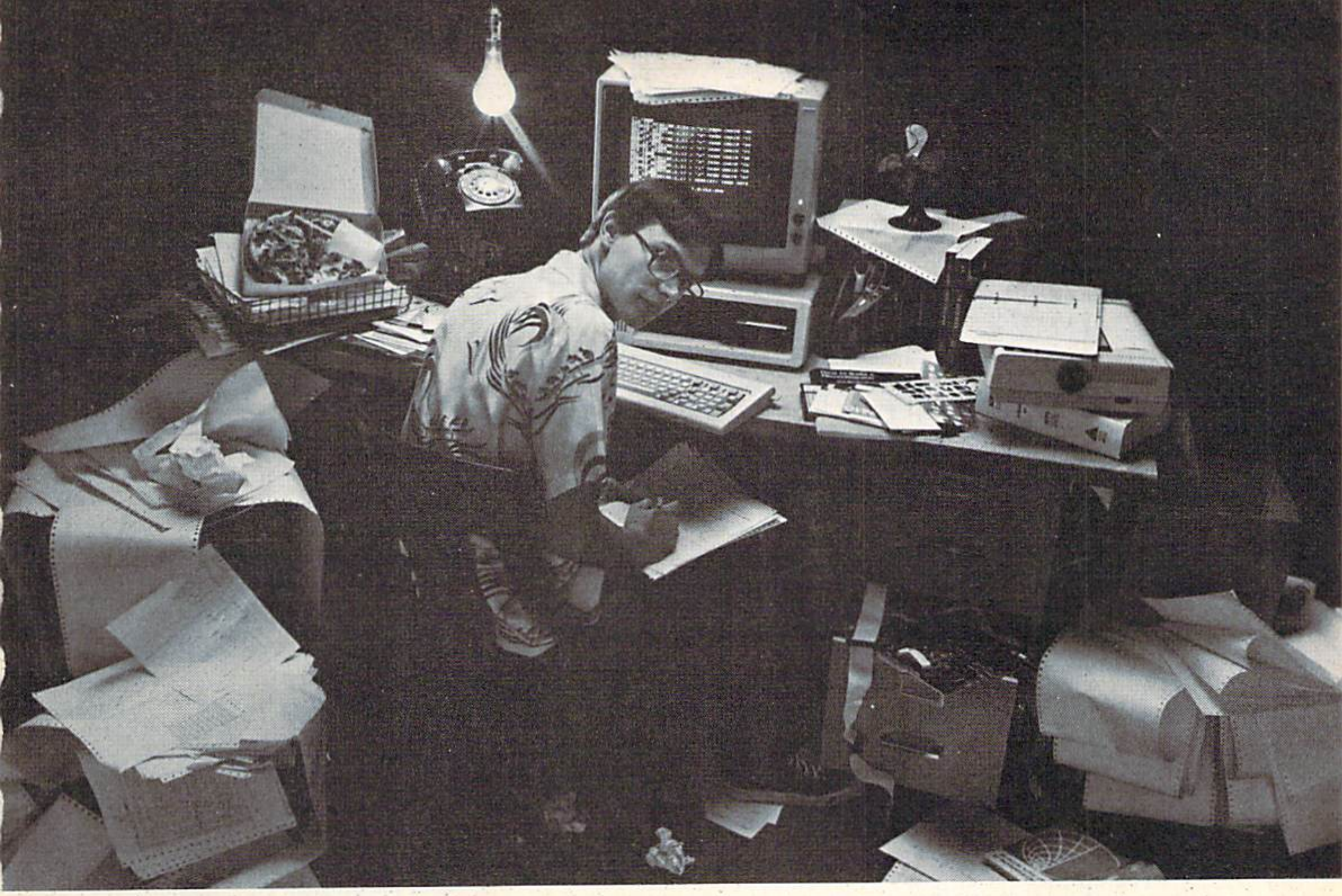
This improved guessing game begins with the dimensioning of a 20-element array, one for each guess. The For-Next loop still allows for 20 turns, but T has been changed to correspond to the subscripts of the array elements. (Remember, they are numbered zero through 19.)

Each guess (G) is placed into an element of the array at line 80. Lines 50–70 check your current guess against the answers already stored in the array. By using FOR CK = 0 TO T in this loop, you avoid wasting time checking a lot of empty cells.

If G, the current guess, does not match the number stored in a cell, the next cell is checked. If a match is found, the player is told to try again. If no match is found, G is placed in the next available cell, and the loop begins again. Line 120 prints out all the numbers stored in the array.

Another Dimension

The "row of boxes" is a one-dimensional array—all the boxes lined up in a single row. If you had a few rows of boxes stacked on top of each other, you'd have a two-dimensional array. (See Fig. 1.)



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```
10 DIMA(5,3)
20 FORPL=1TO5:FORPD=1TO3
30 READ A(PL,PD)
40 NEXTPD:NEXTPL
50 DATA0,2,2,5,2,0,7,0,2,0,0,2,5,7,12
100 PRINT"[SHFT CLR]"
110 PRINT,"1ST","2ND","3RD"
120 FORPL=1TO5:PRINT"[CRSR DN]NO."PL,
130 FORPD=1TO3:PRINTA(PL,PD),:NEXTPD:NEXTPL
```

Listing 4. Program to list the penalty statistics in a hockey game.

```
200 FORPL=1TO5:FORPD=1TO3
210 A(PL,0)=A(PL,0)+A(PL,PD)
220 NEXTPD:NEXTPL
230 PRINT"[HOME][CRSR DN][CRSR DN]"
240 FORPL=1TO5:PRINTTAB(37);A(PL,0):NEXTPL
250 FORPD=1TO3:FORPL=1TO5
260 A(0,PD)=A(0,PD)+A(PL,PD)
270 NEXTPL:NEXTPD
280 PRINT"[CRSR DN]",
290 FORPD=1TO3:PRINTA(0,PD),:NEXTPD
```

Listing 5. Program to sum the rows and columns in the hockey-penalty game.

```
10 DIM A(5,3)
20 FORPL=1TO5:FORPD=1TO3
30 READA(PL,PD)
40 NEXTPD:NEXTPL
50 DATA0,2,2,5,2,0,7,0,2,0,0,2,5,7,12
100 PRINT"[SHFT CLR]"
110 PRINT,"1ST","2ND","3RD"
120 FORPL=1TO5:PRINT"[CRSR DN]NO."PL,
130 FORPD=1TO3:PRINTA(PL,PD),:NEXTPD:NEXTPL
200 FORPL=1TO5:FORPD=1TO3
210 A(PL,0)=A(PL,0)+A(PL,PD)
220 NEXTPD:NEXTPL
230 PRINT"[HOME][CRSR DN][CRSR DN]"
240 FORPL=1TO5:PRINTTAB(37);A(PL,0):NEXTPL
250 FORPD=1TO3:FORPL=1TO5
260 A(0,PD)=A(0,PD)+A(PL,PD)
270 NEXTPL:NEXTPD
280 PRINT"[CRSR DN]",
290 FORPD=1TO3:PRINTA(0,PD),:NEXTPD
```

Listings 4 and 5 combined.

To tell the computer to save 12 cells like the boxes in the illustration, use the command DIM B(2,3). The computer will then save three "rows" of four cells. The cells in the first row are designated B(0,0) through B(0,3). Fig. 2 shows the subscript values for the cells in this two-dimensional array. The computer's memory cells are not actually arranged like this, of course, but it is a helpful visualization.

Two-dimensional arrays have many uses, from spreadsheet programs to keeping track of moves made in a game. Listing 4 is a program that uses a two-dimensional array. Fig. 3 shows the statistics that the program handles, namely, the penalty minutes served by each of five players in the three periods of a hockey game.

You'll notice that the first line of the program dimensions an array that is one element longer and deeper than seems actually needed. This is so you can ignore the zero subscripts and match up the numbers in a more logical manner: A(1,1) is first player, first period; A(2,1) is second player, first period, and so on.

Some purists may cringe at this method and its waste of array space, but its clarity is worth a little cringing. (Besides, the program puts those zero-subscript cells to use later.)

Lines 20–40 read in the data to each cell of the array. Lines 100–130 print a chart on the screen. Follow the punctuation carefully (e.g., the commas at the end of line 120 and after the second command in line 130) in order to print the chart correctly on the C-64.

A Further Step

Looking at the chart printed out by the program in Listing 4 can give you another sense of an array: a picture of rows and columns, rather than stacks of boxes.

Now, what other statistics might you want from this chart? Two are obvious: total minutes for each player and total minutes per period. For the first, you need to sum each *row*: A(1,1) + A(1,2) + A(1,3) through A(5,1) + A(5,2) + A(5,3).

For the per period statistics, we need the sum of each *column*:

A(1,1) + A(2,1) + A(3,1) + A(4,1) + A(5,1)
A(1,2) + A(2,2) + A(3,2) + A(4,2) + A(5,2)
A(1,3) + A(2,3) + A(3,3) + A(4,3) + A(5,3)

Now you need variables to store these eight sums. Although you could set up a single-dimension array to hold them, it so happens you have

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some empty cells available. They'll be used as follows:

A(0,1) = 1st period totals
A(0,2) = 2nd period totals
A(0,3) = 3rd period totals
A(1,0) = 1st player's total
A(2,0) = 2nd player's total

and so on.

Add Listing 5 to your program. Lines 200–220 use nested For–Next loops to sum the rows in the chart and store the answers in A(1,0) through A(5,0). Lines 230 and 240 print the results on the screen. Lines 250–290 sum the columns, store the answers in A(0,1) through A(0,3) and print them on the screen.

There is one other statistic you might want from this program: the total penalty minutes in the game. You may have realized that one array element is still empty: A(0,0). You can use it to store the column totals (row totals will work just as well). Add Listing 6 to your program and run it again.

String Array Applications

String arrays are often used in question/answer games. For simplicity, two single-dimension arrays can be used so that A$(1) is the answer that goes with A$(1). Another use of string arrays is for alphabetical sorting. A third use is for record-keeping and record-searching.

The program in Listing 7 demonstrates this use: a private club has a computer-controlled door that will open only if the right name is given. The program works in much the same way as the subroutine in the number-guessing game; it compares the name given to the name stored in each element of the array.

Multi-Dimensioning

String arrays are not limited to one dimension, nor are numeric arrays limited to two dimensions. Three, four, five or more dimensions are possible. What can you do with them?

Well, you might wish, for instance, to keep track of the hockey players' penalty minutes per period, per game and per *season*. In that case, you'd want a three-dimensional array, and you can visualize the third dimension (seasons) as pages that are filled with rows and columns of numbers.

Although there *are* limits to dimensioning on the Commodore—even with its large memory space—it's unlikely that you'll quickly strain its capacity. ®

0,0	0,1	0,2	0,3
1,0	1,1	1,2	1,3
2,0	2,1	2,2	2,3

Fig. 2. Subscript values for the two-dimensional array B(2,3).

	Period 1	Period 2	Period 3
Player 1	0	2	2
Player 2	5	2	0
Player 3	7	0	2
Player 4	0	0	2
Player 5	5	7	12

Fig. 3. Hockey game penalty statistics.

```
300 FORPD=1TO3:A(0,0)=A(0,0)+A(0,PD):NEXTPD
310 PRINT"[CRSR UP]" TAB(37);A(0,0)
```

Listing 6. Program to sum and store the total penalty minutes in the hockey game.

```
10 DIMA(5,3)
20 FORPL=1TO5:FORPD=1TO3
30 READA(PL,PD)
40 NEXTPD:NEXTPL
50 DATA0,2,2,5,2,0,7,0,2,0,0,2,5,7,12
100 PRINT"[SHFT CLR]"
110 PRINT,"1ST","2ND","3RD"
120 FORPL=1TO5:PRINT"[CRSR DN]NO."PL,
130 FORPD=1TO3:PRINTA(PL,PD),:NEXTPD:NEXTPL
200 FORPL=1TO5:FORPD=1TO3
210 A(PL,0)=A(PL,0)+A(PL,PD)
220 NEXTPD:NEXTPL
230 PRINT"[HOME][CRSR DN][CRSR DN]"
240 FORPL=1TO5:PRINTTAB(37);A(PL,0):NEXTPL
250 FORPD=1TO3:FORPL=1TO5
260 A(0,PD)=A(0,PD)+A(PL,PD)
270 NEXTPL:NEXTPD
280 PRINT"[CRSR DN]",
290 FORPD=1TO3:PRINTA(0,PD),:NEXTPD
300 FORPD=1TO3:A(0,0)=A(0,0)+A(0,PD):NEXTPD
310 PRINT"[CRSR UP]"   TAB(37);A(0,0)
```

Listings 4, 5 and 6 combined.

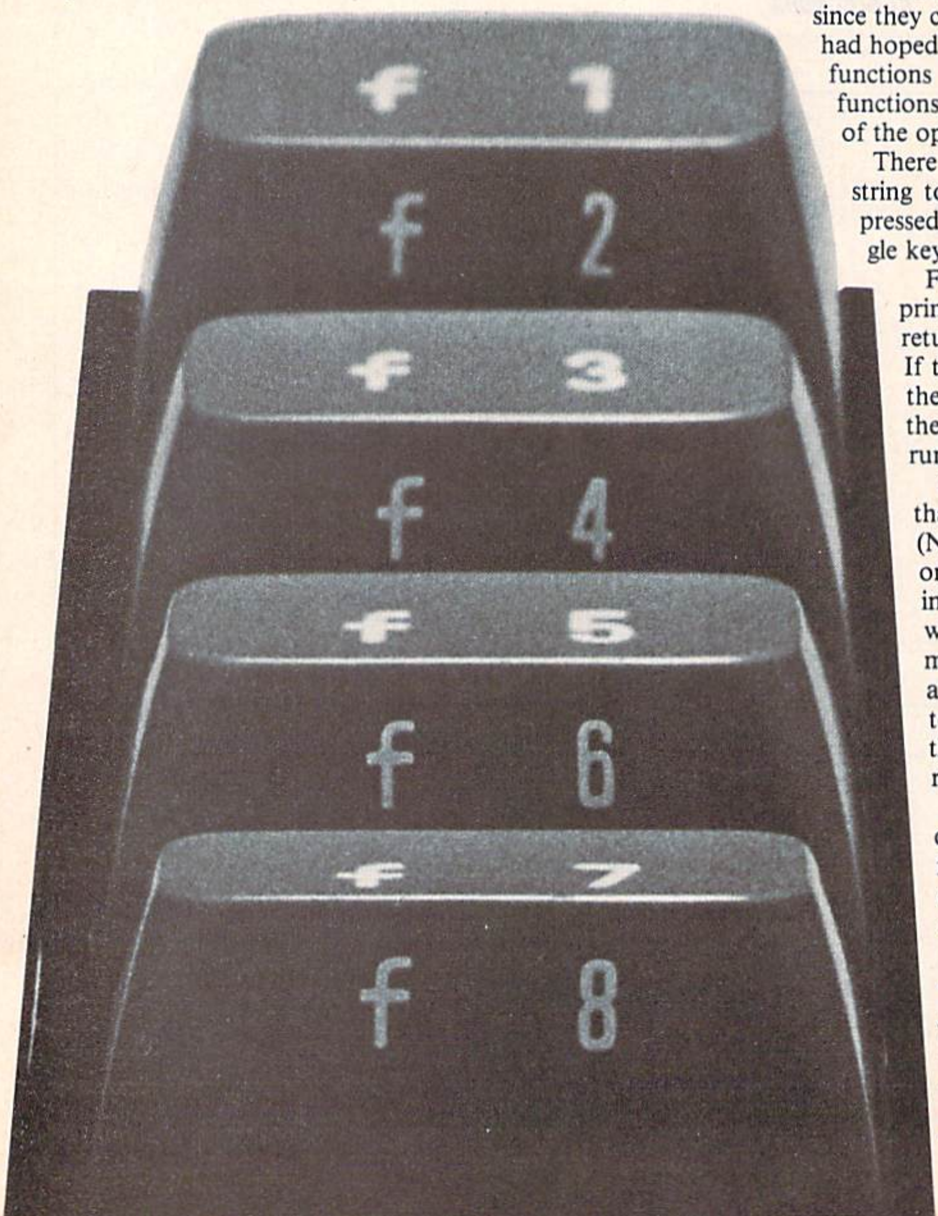
```
10 DIM A$(9)
15 FOR N=0TO9:READA$(N):NEXT
20 PRINT"WHAT IS YOUR NAME?"
25 INPUTB$
30 FOR N=0TO9
35 IFB$=A$(N)THEN PRINT"COME IN":END
40 NEXTN
45 PRINT"GO AWAY":END
50 DATA NICHOLAS,DAN,GLORIA,TOM,JACKIE,TONY,MARCY,DANA,
     AL,NATHANIEL
```

Listing 7. Program illustrating one use of string arrays.

Fancy Fingering On the Function Keys

If you've been wanting a way to define the VIC-20 function keys to your own needs, here's a program that lets you do it with ease.

By John Tanzini



When you first purchased your VIC-20, you undoubtedly wondered about the function keys. You may have been disappointed the first time you pressed one and found that nothing happened.

I can remember searching through the reference manual to determine how to assign functions. I found that the function keys are very easy to use in Basic programs, since they can be input like any other character, but I had hoped for more. I had hoped to be able to assign functions that would aid me in programming—functions that would execute as if they were part of the operating system.

There is a way. If you print a predefined string to the screen every time a function key is pressed, you can execute any function with a single keystroke.

For example, suppose the word LIST is printed when F1 is pressed. Now press the return key, and your program will be listed. If the return key had been defined as part of the string, then simply pressing F1 would list the program. Similarly, F2 could be made to run a program.

I find, while debugging certain programs, that I am constantly typing PRINT PEEK (N), where N is the number of some memory location. Since cursor controls can be included in strings, I can define a string which prints PRINT PEEK ( ) and then moves the cursor back to the position just after the left parenthesis. Then all I have to do is type the number of the location that I wish to interrogate, and press the return key.

You will doubtless have your own idea of what functions should be assigned to the function keys. It is a simple matter to customize my program to your own needs and define the keys any way you like.

Address author correspondence to John Tanzini, Wynbrook West Apt. O-8, Dutch Neck Road, E. Windsor, NJ 08520.

Although part of this program is written in machine language, you need no knowledge of machine language to use the program or to redefine the function keys. So read on and put those function keys to work for you.

Using the Program

A copy of the program is shown in Listing 1. It is not as long as it appears, since you do not have to type in any of the REM statements. Be sure to save a copy of the program before you try to run it.

The most likely place to make a mistake while entering the program is in the Data statements, which contain the machine language program. For that reason, I have included a checksum at the end of each Data statement. The last number of each Data statement is the sum of all the previous numbers in that line.

When the Basic program loads the machine language program, it checks the checksum in each statement. If it does not add up properly, the program assumes that one or more of the numbers in that line was incorrectly typed, and an error message is then printed. The error message tells you exactly which line is incorrect, which should aid you considerably in getting the program running.

When you run the program, you should see a list appear on the screen, showing exactly how the function keys are defined. A few seconds will pass while the machine language program is loading, and then READY will appear on the screen. The Basic program should have automatically cleared itself out of memory by executing a New.

At this time you should be able to use the function keys. Pressing F1, for example, will print the word LIST. Functions F9 through F12 are obtained by pressing the Commodore key and one of the function keys.

Understanding one point about the operation of the Basic program will help you get the program running. The first thing the program does is move the top-of-memory pointer way down to protect a block of memory where the machine language program will reside.

If you have made a typing error in a Data statement, the program will detect

RUN It Right

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Listing 1. Function Keys program for the VIC-20.

```
100 T = PEEK(55) + 256*PEEK(56)
110 POKE 56, PEEK(46)+2
120 POKE 52, PEEK(56)
130 PRINT "[SHFT CLR]FUNCTION KEYS":PRINT
200 DIM F$(12)
210 F$(1) = "LIST "
220 F$(2) = "LOAD"+CHR$(34)
230 F$(3) = "RUN"
240 F$(4) = "SAVE"+CHR$(34)+"@:"
250 F$(5) = "PRINT PEEK([5 SPACES])[6 CRSR LFS]"
260 F$(6) = "OPEN 15,8,15,"+CHR$(34)
270 F$(7) = "PRINT FRE(0)"
280 F$(8) = "CLOSE 15"
290 F$(9) = "GOTO "
300 F$(10) = "GOSUB "
310 F$(11) = "RETURN"
320 F$(12) = "POKE "
330 FOR I = 1 TO 12
340 PRINT"F" + RIGHT$(STR$(I),LEN(STR$(I))-1) + " = ";
345 PRINT CHR$(34) + F$(I) + CHR$(34)
350 NEXT I
400 L = 0
410 FOR I = 1 TO 12
420 L = L + LEN(F$(I))
430 NEXT I
435 IF L > 231 THEN PRINT "[CTRL 9]STRINGS TOO LONG": G
     OTO 800
440 SM = T - 120
450 SS = T - L - 144
500 PP = SS: SP = SS + 12
510 FOR I = 1 TO 7 STEP 2: GOSUB 1000: NEXT I
520 FOR I = 2 TO 8 STEP 2: GOSUB 1000: NEXT I
530 FOR I = 9 TO 12: GOSUB 1000: NEXT I
600 FOR I = SM TO SM+119
610 READ B
611 SU = SU + B
612 C = C + 1
613 IF C<>19 AND I<>(SM+119) THEN 620
614 READ CH
615 IF CH = SU THEN C=0: SU=0: GOTO 620
616 PRINT: PRINT "[CTRL 9]DATA STATEMENT ERROR"
617 PRINT "[CTRL 9]IN LINE"; PEEK(63) + 256*PEEK(64)
618 GOTO 800
620 POKE I, B
630 NEXT I
700 POKE 2, SM/256
710 POKE 1, SM-256*PEEK(2)
720 POKE 252, SS/256
730 POKE 251, SS-256*PEEK(252)
740 POKE 649, 9
750 POKE 55, PEEK(251): POKE 56, PEEK(252)
760 POKE 51, PEEK(251): POKE 52, PEEK(252)
770 SYS 0
780 NEW
800 POKE 56, T/256
810 POKE 55, T - 256*PEEK(56)
820 END
1000 POKE PP, SP-SS: PP = PP+1
1005 IF F$(I) = "" THEN 1060
1010 FOR J = 1 TO LEN(F$(I))
1030 POKE SP, ASC(MID$(F$(I),J,1))
1040 SP = SP+1
1050 NEXT J
1060 POKE SP, 0
1070 SP = SP + 1
1080 RETURN
9000 DATA120,165,2,141,21,3,165,1,24,105,21,144,3,238,2
      1,3,141,20,3,1341
9010 DATA88,96,165,198,208,92,165,254,240,9,169,0,133,2
      54,164,253,24,144,56
9020 DATA2712,162,3,169,63,197,197,240,13,56,233,8,202,
      16,246,169,255,141,128
```

More →

Listing 1 continued.

```
9030 DATA2,2500,48,58,134,253,162,0,173,141,2,201,1,208
     ,2,162,4,201,2,208
9040 DATA2,1962,162,8,138,24,101,253,205,128,2,240,30,1
     41,128,2,168,177,251,168
9050 DATA162,2488,0,177,251,240,17,157,119,2,200,232,13
     4,198,224,9,208,241,132
9060 DATA253,169,2963,1,133,254,76,191,234,889
```

it when calculating the checksum and will branch to line 800. At line 800 the program will restore the top-of-memory pointer, which returns all of the memory back to the operating system. If it did not, the program wouldn't have sufficient memory to execute correctly the next time you tried to run it.

If, however, you enter a Basic statement incorrectly (causing a syntax error), the operating system will stop the program immediately, without restoring anything. If you execute a GOTO 800 right after the program stops, you will save yourself the trouble of turning your VIC off, then on again, and reloading the program. Of course, this problem will not occur once the program is entered as shown in the listing.

You will find that pressing the run/stop and restore keys deactivates the program. This is because the operating system restores the interrupt vector to its original value. The program can be restarted by simply executing a SYS 0.

After you are sure the program is running properly, you may remove lines 611 through 618, along with the last data item in each Data statement. That is the part of the program associated with the checksum. The machine language program will load in about half the time with the checksum removed. Do not forget also to remove the last comma in each Data statement.

Since the machine language program remains in memory after the Basic program clears itself out, you will lose a small amount of memory. Your free memory will decrease by 144 bytes, plus one byte for every character defined in your strings.

Redefining the Function Keys

The function keys F1 through F12 are defined in lines 210 through 320. An array of strings named F$ holds a string associated with each function key. F$(1) is the string defined for F1; F$(2) is the string assigned to F2, and so on. To redefine a function key, simply change the appropriate line of the program corresponding to the function key that you wish to change.

For example, line 210 defines the string for F1:

```
210 F$(1) = "LIST"
```

If, instead, you would like the word LOAD to be printed when F1 is pressed, change line 210 to:

```
210 F$(1) = "LOAD"
```

Be sure to include the quotes, since F$ is a string variable.

Any valid string can be assigned to the function keys, including strings containing cursor controls. There are, however, two characters that are slightly more complicated to assign within a string. They are the Return and the Quote. To include a Return in a string, add CHR$(13) to the string (13 is the ASCII code for Return). For example, if you want F3 to automatically start running a program as soon as you press the key, change line 230 to:

```
230 F$(3) = "RUN" + CHR$(13)
```

The return will be executed immediately after printing RUN, just as if you had pressed the return key on the keyboard. A quote can be included in a string in a similar manner using CHR$(34).

The maximum total length of all the strings you assign to the function keys is 231 characters. If you assign more than 231 characters, the program will print out an error message indicating that your strings are too long. At that time you may simply edit the appropriate lines and run the program again.

Keep in mind that the program clears itself out of memory after it runs. So if you would like to have a permanent copy of the program with your newly

Listing 2. Function Keys program for the C-64.

```
0 REM  FUNCTION KEYS
1 REM  COMMODORE 64 VERSION
2 REM
3 REM  BY JOHN TANZINI
4 REM  AND RON MINDZAK
5 REM
6 REM
7 REM**
8 REM*** VARIABLE LIST
9 REM**
10 REM T = ACTUAL TOP OF MEMORY
15 REM L = TOTAL LENGTH OF ALL STRINGS DEFINED FOR FUNC
    TION KEYS
20 REM SM = START OF MACHINE LANGUAGE PROGRAM
25 REM SS = START OF STRINGS DEFINED FOR FUNCTION KEYS
30 REM PP = POINTER TO STRING POINTERS
35 REM SP = POINTER TO STRINGS DURING LOADING OF STRING
    S
40 REM C = COUNTER TO DETERMINE IF BYTE READ FROM DATA
    STATEMENT IS A CHECKSUM
45 REM SU = SUM USED TO DETERMINE CHECKSUM
50 REM CH = CHECKSUM READ FROM DATA STATEMENT
55 REM B = BYTE READ FROM DATA STATEMENT
96 REM
97 REM**
98 REM*** CALCULATE TOP OF MEMORY AND RESERVE MEMORY FO
    R STRINGS
99 REM**
100 T = PEEK(55) + 256*PEEK(56)
110 POKE 56, PEEK(46)+2
120 POKE 52, PEEK(56)
130 PRINT "[SHFT CLR]FUNCTION KEYS":PRINT
196 REM
197 REM**
198 REM*** DEFINE STRINGS AND PRINT THEM OUT
199 REM**
200 DIM F$(12)
210 F$(1) = "LIST "
220 F$(2) = "LOAD"+CHR$(34)
230 F$(3) = "RUN"
240 F$(4) = "SAVE"+CHR$(34)+"@:"
250 F$(5) = "PRINT PEEK(      )[CRSR LF][CRSR LF][CRSR L
    F][CRSR LF][CRSR LF][CRSR LF]"
260 F$(6) = "OPEN 15,8,15,"+CHR$(34)
270 F$(7) = "PRINT FRE(0)"
280 F$(8) = "CLOSE 15"
290 F$(9) = "GOTO "
300 F$(10) = "GOSUB "
310 F$(11) = "RETURN"
320 F$(12) = "POKE "
330 FOR I = 1 TO 12
340 PRINT"F" + RIGHT$(STR$(I),LEN(STR$(I))-1) + " = ";
345 PRINT CHR$(34) + F$(I) + CHR$(34)
```

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Listing 2 continued.

```
350 NEXT I
396 REM
397 REM**
398 REM** DETERMINE STARTING LOCATIONS FOR STRINGS AND
     MACHINE LANGUAGE PROGRAM
399 REM**
400 L = 0
410 FOR I = 1 TO 12
420 L = L + LEN(F$(I))
430 NEXT I
435 IF L > 231 THEN PRINT "[CTRL 9]STRINGS TOO LONG": G
     OTO 800
440 SM = T - 132
450 SS = T - L - 156
496 REM
497 REM**
498 REM*** STORE STRINGS AND POINTERS
499 REM**
500 PP = SS: SP = SS + 12
510 FOR I = 1 TO 7 STEP 2: GOSUB 1000: NEXT I
520 FOR I = 2 TO 8 STEP 2: GOSUB 1000: NEXT I
530 FOR I = 9 TO 12: GOSUB 1000: NEXT I
596 REM
597 REM**
598 REM*** LOAD MACHINE LANGUAGE PROGRAM
599 REM**
600 FOR I = SM TO SM+131
610 READ B
611 SU = SU + B
612 C = C + 1
613 IF C<>19 AND I<>(SM+131) THEN 620
614 READ CH
615 IF CH = SU THEN C=0: SU=0: GOTO 620
616 PRINT: PRINT "[CTRL 9]DATA STATEMENT ERROR"
617 PRINT "[CTRL 9]IN LINE"; PEEK(63) + 256*PEEK(64)
618 GOTO 800
620 POKE I, B
630 NEXT I
696 REM
697 REM**
698 REM*** SETUP FOR MACHINE LANGUAGE PROGRAM
699 REM**
700 POKE 250, SM/256
710 POKE 249, SM-256*PEEK(250)
715 POKE 248, 76
720 POKE 252, SS/256
730 POKE 251, SS-256*PEEK(252)
740 POKE 649, 9
750 POKE 55, PEEK(251): POKE 56, PEEK(252)
760 POKE 51, PEEK(251): POKE 52, PEEK(252)
761 POKE T-13, PEEK(789)
762 POKE T-14, PEEK(788)
770 SYS 248
780 NEW
796 REM
797 REM**
798 REM*** RESTORE THE ACTUAL TOP OF MEMORY IF AN ERROR
     OCCURS
799 REM**
800 POKE 56, T/256
810 POKE 55, T - 256*PEEK(56)
820 END
996 REM
997 REM**
998 REM*** SUBROUTINE TO STORE STRINGS FOR F$(I)
999 REM**
1000 POKE PP, SP-SS: PP = PP+1
1005 IF F$(I) = "" THEN 1060
1010 FOR J = 1 TO LEN(F$(I))
1030 POKE SP, ASC(MID$(F$(I),J,1))
1040 SP = SP+1
1050 NEXT J
1060 POKE SP, 0
1070 SP = SP + 1
1080 RETURN
8996 REM
8997 REM**
8998 REM*** DATA FOR MACHINE LANGUAGE PROGRAM
8999 REM**
9000 DATA120,165,250,141,21,3,165,249,24,105,21,144,3,2
     38,21,3,141,20,3,1837,88
9010 DATA96,165,198,208,92,165,254,240,91,169,0,133,254
     ,164,253,24,144,56,2794
9020 DATA201,6,240,17,202,201,5,240,12,202,201,4,240,7,
     169,255,141,128,2,2473
9030 DATA48,58,134,253,162,0,173,141,2,201,1,208,2,162,
     4,201,2,208,2,1962,162
9040 DATA8,138,24,101,253,205,128,2,240,30,141,128,2,16
     8,177,251,168,162,2488,0
9050 DATA177,251,240,17,157,119,2,200,232,134,198,224,9
     ,208,241,132,253,169,2963
9060 DATA1,133,254,76,49,234,162,3,165,197,201,3,240,18
     7,202,24,144,162,2437
```

defined functions, remember to save the program before you run it.

The following is a brief description of how the machine language section of the program works. For a commented assembly-language listing of the program, send an SASE to *RUN* magazine.)

The general technique used to activate the function keys is fairly simple. Sixty times every second, a hardware interrupt is generated that signals the operating system to perform certain housekeeping functions such as scanning the keyboard and updating the real-time clock. By intercepting this interrupt, the machine language program executes sixty times a second.

Every time the program executes, it checks to see if one of the function keys is pressed. If one is pressed, the keyboard buffer is loaded with as many characters of the appropriate string as it can hold. As soon as the keyboard buffer is emptied by the operating system, my program will load more of the string into the buffer, until the string is completely printed.

The Basic Program

The functions of the Basic program are: to load the machine language program at the top of memory; to load the strings just below the machine code; to set up pointers for the machine language program; and to protect program and strings from the rest of the operating system.

Lines 100 to 130. Reserve enough memory to load the machine language program and strings by changing the top-of-memory pointer to point 512 bytes above the Basic program.

Lines 200 to 350. The array F$ is created, and the strings associated with each function key are printed to remind the user how they are defined.

Lines 400 to 450. The total length of all the strings is calculated. It is verified that their length does not exceed 231 characters. If the strings are valid, then SM (start of machine language program) and SS (start of strings) are calculated.

Lines 500 to 530. The strings and a table of pointers to the strings are loaded, beginning at location SS.

Lines 600 to 630. The machine language program is read from the Data statements and is loaded, beginning at location SM.

Lines 700 to 780. A pointer to the machine language setup routine is stored in memory. The top of memory is changed to point to the beginning of the strings, so that only as much memory as is needed is taken away from the operating system. The program jumps to the machine language setup routine, then executes a New.

Lines 800 to 820. Execution reaches this point only if an error occurs, such as defining strings that are too long. The top of memory is restored to its original value in order to return all the memory to the operating system before stopping.

Lines 1000 to 1080. This is the subroutine that takes a string F$(I) and loads it into memory. A pointer to the string is also loaded into a table.

Conclusion

The power of this program lies in the fact that you can customize it to your own needs. If you have a printer, for example, one of the keys can be defined to give you a printout with a single keystroke. Some of the commands I have defined are useful only if you have a disk drive. If you define the set of functions that you use the most, you will find this program very handy. R

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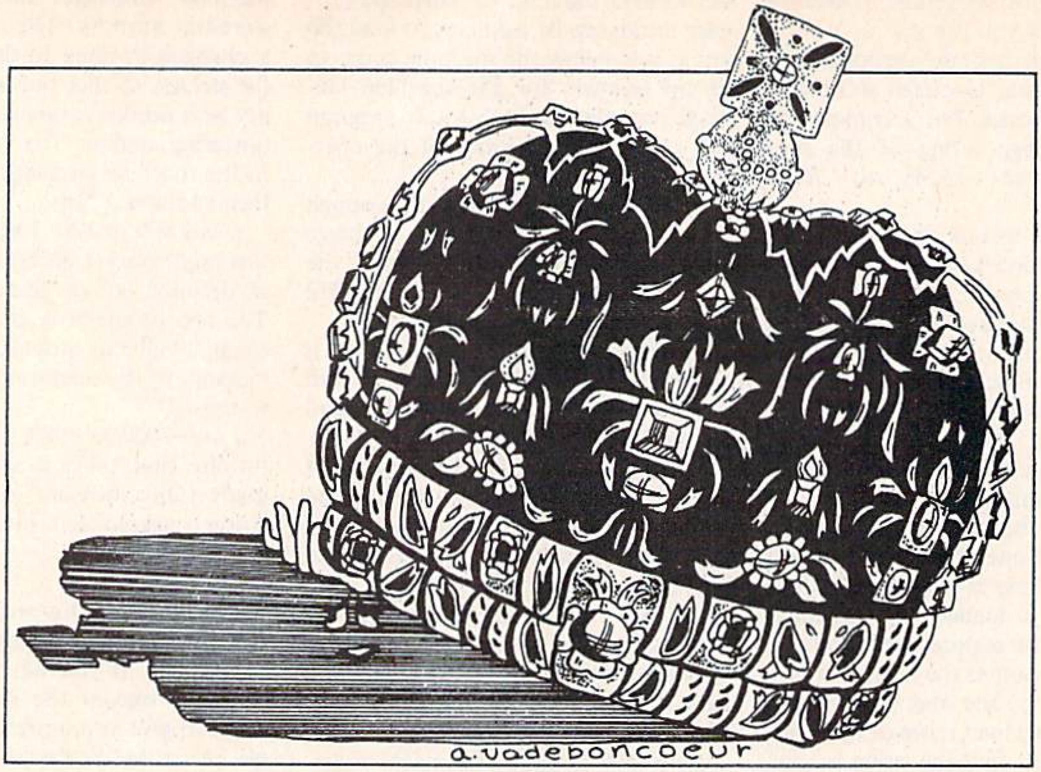

Iron Hand or VIC-20?
How Would You Rule Your Kingdom?

As a royal ruler in this game, you've got to think quickly to expand your kingdom while forestalling grain drain, especially in time of war.

By Joseph J. Shaughnessy

RUN It Right

VIC-20 or Commodore 64

Address author correspondence to Joseph J. Shaughnessy, 4703 Country Club Drive, Pittsburgh, PA 15236.

This game is both fun and educational. You must continually juggle numbers and computations in your head, but it's not a painful process. (The program will work with any memory configuration of the VIC-20, including unexpanded, and also with the C-64. See Listings 1 and 2.)

You are the ruler of a small city-state in ancient times. Your major goal in life is to increase the size of your kingdom, and you measure your progress towards this goal by the number of acres that you own. To be successful, you'll find that caring and concern for the people under your rule may not always be productive in accomplishing your goal. However, total disregard of your people also carries penalties.

Royal Decisions

As the game begins, you own land, have grain in storage and also have a population to govern. During each round of play (measured as one year for each round), you must buy or sell land, set aside grain for feeding the population during the year and determine how many acres to plant.

There are many factors to ponder in planning for the coming year. Is the state at war or peace? Is there sufficient food to feed the population, or should some of the people be allowed to starve? Are there enough people to do the work of planting and harvesting—and for military service if there is war? Is the price of land high or low? Have you saved enough grain for seed? Are there any fringe benefits with this job?

To aid you with your job, the State of the Realm report is constantly displayed and updated as you are requested to give orders for the upcoming year. Also, at the end of each year, the Grand Secretary of State will give you a report of the results of your decisions, including such things as harvest yield, census changes and the state of the treasury.

You could discover, through trial and error, the requirements for distributing grain to your various priorities, but that is maddening. Instead, I will tell you the following: each person requires 20 bushels of grain to eat; each person can only plant 10 acres of land; seed requirements are ½ bushel per acre.

In time of war, one-third of the population is required for the army and is not available for agriculture (they still eat, though). You will find yourself at war about 30 percent of the time.

Listing 1. Rule the Kingdom program for the VIC-20.

```
10 REM RULE THE KINGDOM BY J. SHAUGHNESSY
12 XM=242:POKE36879,93 :POKE646,0:IF PEEK(4096) THEN XM
    =194
14 POKE36869,XM:P=100:AR=10:SP=0:RD=150:YH=3:GH=3000:CA
    =1000:YR=1:GS=2850
16 GOTO114
18 REM SUBROUTINES
20 PRINT"[SHFT CLR][CTRL 8][CRTL 9][2 SPACES][SHFT S]TA
    TE[SHFT SPACE][SHFT O]F [SHFT T]HE [SHFT R]EALM  [
    CTRL 0]";
22 PRINT"[CRSR DN][CTRL 2][CRTL 9][SHFT P]EOPLE:";P
24 PRINT"[CTRL 1][CRTL 9][SHFT A]CRES :";CA
26 PRINT"[CTRL 3][CRTL 9][SHFT B]U. [SHFT S]TORED:";GS
28 PRINT"[CTRL 1][CRSR DN][SHFT K]INGDOM IS AT ";PW$
30 PRINT"[CRTL 9][22 SPACES][CTRL 0]":RETURN
32 I=VAL(I$):I=INT(ABS(I)):RETURN
34 REM DELAY LOOP
36 FORX=1TO4000:NEXT:RETURN
38 REM WAIT FOR KEY
40 PRINT"[CRSR DN][SHFT H]IT A KEY TO PROCEED"
42 GETA$:IFA$=""THEN42
44 RETURN
46 PRINT"[SHFT CLR][CRTL 9]* [SHFT H]AIL [SHFT G]REAT [
    SHFT R]ULER ! *[CTRL 0]"
48 PRINT"[SHFT I] BEG TO  REPORT THAT IN THE YEAR[CRTL
    9]";YR;"[CTRL 0]OF"
50 PRINT"YOUR REIGN:[CRSR DN]"
52 IF SP=1THEN58
54 IFSP=0THENPRINT" [SHFT N]OBODY STARVED, AND":GOTO60
56 PRINT SP;"PEOPLE STARVED,AND";:GOTO60
58 PRINT"[SHFT O]NE PERSON STARVED,AND";
60 IFWK<1THEN68
62 IFWK=1THENPRINT"[SHFT O]NE";:GOTO66
64 PRINTWK;
66 PRINT"DIED IN BATTLE"
68 IFAR=1THEN72
70 PRINT AR;"PEOPLE CAME TO THE    KINGDOM":GOTO76
72 IFSP<10ANDSP>1ANDWK<1THENPRINT" ";
74 PRINT"ONE PERSON CAME TO THEKINGDOM."
76 PRINT"[CRSR DN][SHFT W]E HARVESTED ";GH
78 PRINT"BUSHELS AT ";YH;"BUSHELS"
80 PRINT"PER ACRE."
82 PRINT"[SHFT R]ATS RUINED";RD;"BU."
84 PRINT"LEAVING";GS
86 PRINT"BUSHELS IN STORAGE."
88 PRINT"[CRSR DN][SHFT T]HE KINGDOM HAS";CA
90 PRINT"ACRES OF LAND."
92 RETURN
94 PRINT"[CRSR DN][SHFT O][SHFT H] [SHFT K]ING...THINK
    AGAIN!":GOSUB36:RETURN
96 PRINT"[CRSR DN][SHFT T]HE STARVING PEASANTS RAIDED T
    HE WAREHOUSES"
98 PRINT"AND DESTROYED 50% OF  THE STORED GRAIN"
100 GS=INT(GS/2):WR=0:GOSUB36:RETURN
102 IFJ>0THENRETURN
104 P=P-INT(P/2):PRINT"[SHFT T]HE PLAGUE KILLED HALFOF
    THE PEOPLE."
106 PRINT"[SHFT T]HE POPULATION IS NOW ";P;".":GOSUB36:
    RETURN
108 IFSP<PTHENRETURN
```

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Listing 1 continued.

```
110 PRINT"[SHFT CLR][CRSR DN][CRSR DN][SHFT A]LL OF YOU
     R SUBJECTS  ARE [SHFT D]EAD......        [CRSR DN]
     [SHFT S]O ARE YOU![CRSR DN][CRSR DN]"
112 GOTO236
114 PRINT"[SHFT CLR][CRTL 9][3 SPACES][SHFT R]ULE [SHFT
      T]HE [SHFT K]INGDOM[3 SPACES][CTRL 0]"
116 PRINT"[CRSR DN][SHFT W]HERE YOU GOVERN THE  ANCIENT
      [SHFT K]INGDOM OF[4 SPACES][SHFT B]ABYLON"
118 PRINT"[CRSR DN][SHFT T]HE OBJECT IS TO KEEP THE [SH
     FT K]INGDOM GROWING"
120 PRINT"[CRSR DN][SHFT I]F YOU WANT TO QUIT,  SELL AL
     L OF YOUR LAND."
122 GOSUB38
124 ZZ=RND(TI):GOTO128
126 ZZ=RND(1):IFZZ<.3THENPW$="[SHFT W][SHFT A][SHFT R]"
     :WF=1.5:GOTO130
128 WF=1:PW$="[SHFT P][SHFT E][SHFT A][SHFT C][SHFT E]"

130 GOSUB46:GOSUB38:GOSUB20
132 K=INT(RND(1)*12+16):PRINT"[SHFT L]AND IS WORTH ";K
134 PRINT"BUSHELS PER ACRE.[CRSR DN]"
136 PRINT"[CRTL 9][SHFT B][CTRL 0]UY,[CRTL 9][SHFT S][C
     TRL 0]ELL,OR [CRTL 9][SHFT H][CTRL 0]OLD [SHFT L]A
     ND"
138 GOSUB42
140 IFA$="B"ORA$="S"ORA$="H"THEN144
142 PRINT"[CRSR LF] [CRSR LF][CRSR UP]":GOTO138
144 IFA$="H"THEN172
146 PRINT"[CRSR DN][SHFT H]OW MANY ACRES"
148 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
150 IFI$="*"THENPRINT"[CRSR UP][CRSR UP]":GOTO148
152 GOSUB32:IFI=0THEN172
154 IFA$="S"THEN164
156 J=I*K:IFJ<=GSTHEN160
158 GOSUB94:GOSUB20:GOTO136
160 GS=GS-J:CA=CA+I
162 GOSUB20:GOTO172
164 IFI=CATHEN234
166 IFI>CATHENGOSUB94:GOSUB20:GOTO146
168 CA=CA-I:GS=GS+K*I
170 GOSUB20
172 PRINT:PRINT"[SHFT D]ISTRIBUTE HOW MANY   BUSHELS FO
     R FOOD"
174 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
176 IFI$="*"THENPRINT"[CRSR UP][CRSR UP][CRSR UP]":GOTO
     174
178 GOSUB32
180 IFI<=GSTHEN184
182 GOSUB94:GOSUB20:GOTO172
184 IFI>(5*P)THEN190
186 IFI>GS/4THEN190
188 WR=1:REM WAREHS RAID
190 GS=GS-I:SP=P-INT(I/20):AR=0:GOSUB108:IFSP>=0THEN194

192 AR=-SP/2:SP=0
194 IFWR=1THENGOSUB96
196 GOSUB20
198 PRINT"[SHFT H]OW MANY ACRES SHALL  WE PLANT"
200 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
202 IFI$="*"THENPRINT"[CRSR UP][CRSR UP][CRSR UP]":GOTO
     200
204 GOSUB32
206 IFI>CATHEN214
208 J=INT(I/2):IFJ>GSTHEN214
210 IFI>(10*P/WF)THEN214
212 GOTO218
214 GOSUB94:GOSUB20:GOTO198
216 REM CALC CHANGES FOR YEAR
218 GS=GS-J:YH=1+INT(RND(1)*5):GH=YH*I:RD=INT((GS+GH)*.
     07*RND(1)):GS=GS-RD+GH
220 J=INT(RND(1)*25):IFWF=1.5THENWK=INT(.3*RND(1)*P):GO
     TO224
```

More →

For the good of your Kingdom, you may have to let some of your people starve.

You can experiment with various styles of governing, but I've found that most progress toward your goal is made by buying and selling land at the correct time. You may sometimes have to sell land in order to feed your people, and you may sometimes have to let some of them starve. It was a hard world in those times.

Program Description

REM statements have been placed at certain points within the program. For the unexpanded VIC-20, memory is critical, and the REM statements should probably be deleted. Also, using abbreviations for Basic statements is a good space-saving tool in programming. For instance, the abbreviation for the Print command is ?. Every time you come to a Print, type in ? instead.

Lines 10–16 set up the screen color, assign initial values to the variables and direct the computer to the Title display. Lines 18–112 are subroutines, placed at the beginning of the program for quicker access.

Every time a subroutine is called, the computer starts searching at the beginning of the program and will look at all the line numbers, in order, until the subroutine is found. If you put your subroutines near the beginning, the computer will find them quicker.

This program makes extensive use of subroutines: lines 20–30 display the State of the Realm; line 36 is a delay loop; lines 38–44 wait for a keystroke from the keyboard; lines 46–92 display the end-of-year report; line 94 tells you that you don't have the resources to accomplish your last command; lines 96–112 give you assorted bad news.

Lines 114–122 display the title; line 124 initially "seeds" the random number generator and skips over line 126 so that you start out at peace; lines 126–130 check for war or peace and send the program to the State of the Realm display; lines 132–134 randomly determine the current price of land; lines 136–214 ask for your commands for the coming year and determine some of the results; lines 216–232 calculate changes for the yearly report; finally, lines 234–248 end the game and tell you how you've done.

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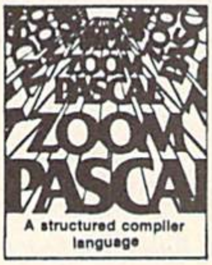
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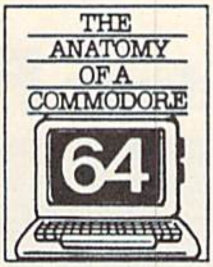
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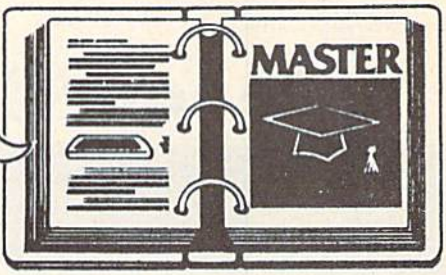

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Listing 1 continued.

```
222 WK=0
224 AR=INT(AR+(5-YH)*GS/600+1):IFAR<=99THEN228
226 AR=99
228 IFAR<0THENAR=0
230 P=P+AR-SP-WK:YR=YR+1
232 GOSUB102:GOTO126
234 PRINT"[SHFT CLR][CRSR DN][SHFT Y]OU HAVE SOLD ALL O
     F  YOUR LAND,THE GAME IS OVER"
236 PRINT"[CRSR DN][SHFT Y]OU CAN GO BACK TO    BEING Y
     OURSELF."
238 CA=CA+INT(GS/K):B$="INCREASED"
240 IF CA<1130THENB$="DECREASED"
242 PRINT"[CRSR DN][SHFT D]URING YOUR REIGN,YOU",B$;" T
     HE WEALTH"
244 PRINT"OF THE KINGDOM BY FACTOR OF";INT((CA/1130)*10
     00)/1000;"IN";
246 PRINTYR;" YEARS."
248 END
```

Listing 2. Rule the Kingdom program for the C-64.

```
10 REM RULE THE KINGDOM BY J. SHAUGHNESSY
12 POKE53281,1:PRINT"[CTRL 1]";CHR$(14)
14 P=100:AR=10:SP=0:RD=150:YH=3:GH=3000:CA=1000:YR=1:GS
     =2850
16 GOTO114
18 REM SUBROUTINES
```

More →

Variables Used

A list of the variables used in this program is as follows: p = population; ar = new arrivals to the city; sp = number of people who starved; rd = grain destroyed by rats; yh = harvest yield in bushels per acre; gh = total bushels harvested; gs = current bushels in storage; ca = acres owned by the kingdom; yr = current year of your reign; pw$ = war or peace; a$, i$, i, j, zz, x = temporary variables; wk = number killed in war; wr = flag for warehouse raid; wf = population efficiency factor for war or peace; k = current price of land; b$ = increase or decrease in kingdom size.

Conclusion

This game is a lot of fun. The first time I played it (on another brand of computer), I must have played for two hours non-stop. In my opinion, you'll gain a better understanding of how the program works by typing it into your computer yourself. However, I'll make tape or disk copies for those unwilling or unable to type it in themselves. Just send me $3, a blank tape or *formatted* disk and a self-addressed, stamped, return mailer. R

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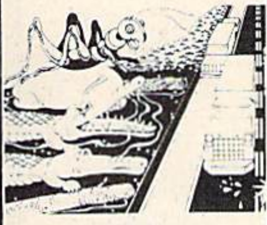

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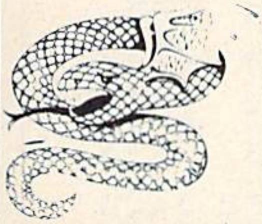

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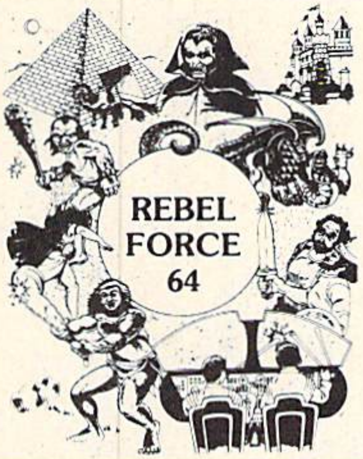

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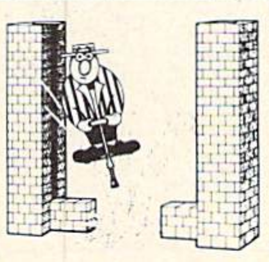

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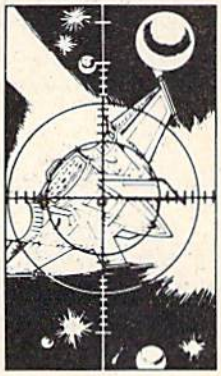

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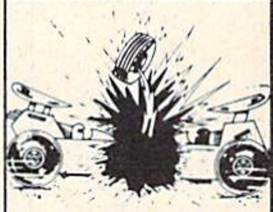

HEAD ON

Listing 2 continued.

```
20 PRINT"[SHFT CLR][10 SPACES][CRTL 9][SHFT S]TATE[SHFT
     SPACE]OF[SHFT SPACE][SHFT T]HE[SHFT SPACE][SHFT R
    ]EALM  [CTRL 0]":PRINT
22 PRINTSPC(13);" [CRTL 9][SHFT P]EOPLE:";P
24 PRINTSPC(13);" [CRTL 9][SHFT A]CRES :";CA
26 PRINTSPC(13);" [CRTL 9][SHFT B]U. [SHFT S]TORED:";GS

28 PRINTSPC(13);" [CRSR DN][SHFT K]INGDOM IS AT ";PW$
30 PRINT:PRINT"[CRTL 9][39 SPACES][CTRL 0]":PRINT:RETUR
    N
32 I=VAL(I$):I=INT(ABS(I)):RETURN
34 REM DELAY LOOP
36 FORX=1TO4000:NEXT:RETURN
38 REM WAIT FOR KEY
40 PRINTSPC(11);"[CRSR DN][SHFT H]IT A KEY TO PROCEED"
42 GETA$:IFA$=""THEN42
44 RETURN
46 PRINT"[SHFT CLR][CRTL 9]* [SHFT H]AIL [SHFT G]REAT [
    SHFT R]ULER ! *[CTRL 0]"
48 PRINT"[SHFT I] BEG TO REPORT THAT IN THE YEAR[CRTL 9
    ]";YR;"[CTRL 0]OF"
50 PRINT"YOUR REIGN:[CRSR DN]"
52 IF SP=1THEN58
54 IFSP=0THENPRINT" [SHFT N]OBODY STARVED, AND":GOTO60
56 PRINT SP;"PEOPLE STARVED,AND";
57 GOTO60
58 PRINT"[SHFT O]NE PERSON STARVED,AND ";
60 IFWK<1THEN68
62 IFWK=1THENPRINT"[SHFT O]NE ";:GOTO66
64 PRINTWK;
66 PRINT"DIED IN BATTLE"
68 IFAR=1THEN74
70 PRINT AR;"PEOPLE CAME TO THE KINGDOM":GOTO76
72 IFSP<10ANDSP>1ANDWK<1THENPRINT" ";
74 PRINT" ONE PERSON CAME TO THE KINGDOM."
76 PRINT"[CRSR DN][SHFT W]E HARVESTED";GH;
78 PRINT"BUSHELS AT";YH;"BUSHELS"
80 PRINT"PER ACRE."
82 PRINT"[SHFT R]ATS RUINED";RD;"BU.";
84 PRINT"LEAVING";GS
86 PRINT"BUSHELS IN STORAGE."
88 PRINT"[CRSR DN][SHFT T]HE KINGDOM HAS";CA;
90 PRINT"ACRES OF LAND."
92 RETURN

94 PRINT"[CRSR DN][SHFT O][SHFT H] [SHFT K]ING...THINK
    AGAIN!":GOSUB36:RETURN
96 PRINT"[CRSR DN][SHFT T]HE STARVING PEASANTS RAIDED T
    HE WAREHOUSES"
```

```
98 PRINT"AND DESTROYED 50% OF  THE STORED GRAIN"
100 GS=INT(GS/2):WR=0:GOSUB36:RETURN
102 IFJ>0THENRETURN
104 P=P-INT(P/2):PRINT"[SHFT T]HE PLAGUE KILLED HALF OF
     THE PEOPLE."
106 PRINT"[SHFT T]HE POPULATION IS NOW ";P;".":GOSUB36:
    RETURN
108 IFSP<PTHENRETURN
110 PRINT"[SHFT CLR][CRSR DN][CRSR DN][SHFT A]LL OF YOU
    R SUBJECTS  ARE [SHFT D]EAD......        [CRSR DN]
    [SHFT S]O ARE YOU![CRSR DN][CRSR DN]"
112 GOTO236
114 PRINT:PRINT"[SHFT CLR][CRSR DN][CRSR DN][9 SPACES][
    CRTL 9][3 SPACES][SHFT R]ULE [SHFT T]HE [SHFT K]IN
    GDOM[3 SPACES][CTRL 0]"
116 PRINT"[CRSR DN][SHFT W]HERE YOU GOVERN THE ANCIENT
    [SHFT K]INGDOM OF [SHFT B]ABYLON"
118 PRINT"[CRSR DN][SHFT T]HE OBJECT IS TO KEEP THE [SH
    FT K]INGDOM[7 SPACES]GROWING"
120 PRINT"[CRSR DN][SHFT I]F YOU WANT TO QUIT, SELL ALL
     OF YOUR[3 SPACES]LAND."
122 GOSUB38
124 ZZ=RND(TI):GOTO128
126 ZZ=RND(1):IFZZ<.3THENPW$="[SHFT W][SHFT A][SHFT R]"
    :WF=1.5:GOTO130
128 WF=1:PW$="[SHFT P][SHFT E][SHFT A][SHFT C][SHFT E]"
130 GOSUB46:GOSUB38:GOSUB20
132 K=INT(RND(1)*12+16):PRINT"[SHFT L]AND IS WORTH";K;
134 PRINT"BUSHELS PER ACRE.[CRSR DN]"
136 PRINT"    [CRTL 9][SHFT B][CTRL O]UY,[CRTL 9][SHFT
    S][CTRL 0]ELL,OR [CRTL 9][SHFT H][CTRL 0]OLD [SHFT
     L]AND"
138 GOSUB42
140 IFA$="B"ORA$="S"ORA$="H"THEN144
142 PRINT"[CRSR LF] [CRSR LF][CRSR UP]":GOTO138
144 IFA$="H"THEN172
146 PRINT"[CRSR DN][SHFT H]OW MANY ACRES"
148 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
150 IFI$="*"THENPRINT"[CRSR UP][CRSR UP]":GOTO148
152 GOSUB32:IFI=0THEN172
154 IFA$="S"THEN164
156 J=I*K:IFJ<=GSTHEN160
158 GOSUB94:GOSUB20:GOTO136
160 GS=GS-J:CA=CA+I
162 GOSUB20:GOTO172
164 IFI=CATHEN234
166 IFI>CATHENGOSUB94:GOSUB20:GOTO146
168 CA=CA-I:GS=GS+K*I
170 GOSUB20
```

More →

Listing 2 continued.

```
172 PRINT:PRINT"[SHFT D]ISTRIBUTE HOW MANY BUSHELS FOR
      FOOD"
174 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
176 IFI$="*"THENPRINT"[CRSR UP][CRSR UP][CRSR UP]":GOTO
      174
178 GOSUB32
180 IFI<=GSTHEN184
182 GOSUB94:GOSUB20:GOTO172
184 IFI>(5*P)THEN190
186 IFI>GS/4THEN190
188 WR=1:REM WAREHS RAID
190 GS=GS-I:SP=P-INT(I/20):AR=0:GOSUB108:IFSP>=0THEN194

192 AR=-SP/2:SP=0
194 IFWR=1THENGOSUB96
196 GOSUB20
198 PRINT"   [SHFT H]OW MANY ACRES SHALL WE PLANT"
200 INPUT"*[CRSR LF][CRSR LF][CRSR LF]";I$
202 IFI$="*"THENPRINT"[CRSR UP][CRSR UP][CRSR UP]":GOTO
      200

204 GOSUB32
206 IFI>CATHEN214
208 J=INT(I/2):IFJ>GSTHEN214
210 IFI>(10*P/WF)THEN214
212 GOTO218
214 GOSUB94:GOSUB20:GOTO198
216 REM CALC CHANGES FOR YEAR
218 GS=GS-J:YH=1+INT(RND(1)*5):GH=YH*I:RD=INT((GS+GH)*.
      07*RND(1)):GS=GS-RD+GH
220 J=INT(RND(1)*25):IFWF=1.5THENWK=INT(.3*RND(1)*P):GO
      TO224

222 WK=0
224 AR=INT(AR+(5-YH)*GS/600+1):IFAR<=99THEN228
226 AR=99
228 IFAR<0THENAR=0
230 P=P+AR-SP-WK:YR=YR+1
232 GOSUB102:GOTO126

234 PRINT"[SHFT CLR][CRSR DN][SHFT Y]OU HAVE SOLD ALL O
      F YOUR LAND,THE GAME IS OVER"
236 PRINT"[CRSR DN][SHFT Y]OU CAN GO BACK TO BEING YOUR
      SELF."
238 CA=CA+INT(GS/K):B$=" INCREASED"
240 IF CA<1130THENB$=" DECREASED"
242 PRINT"[CRSR DN][SHFT D]URING YOUR REIGN,YOU";B$;" T
      HE WEALTH"
244 PRINT"OF THE KINGDOM BY FACTOR OF";INT((CA/1130)*10
      00)/1000;"IN";
246 PRINTYR;" YEARS."
248 END
```

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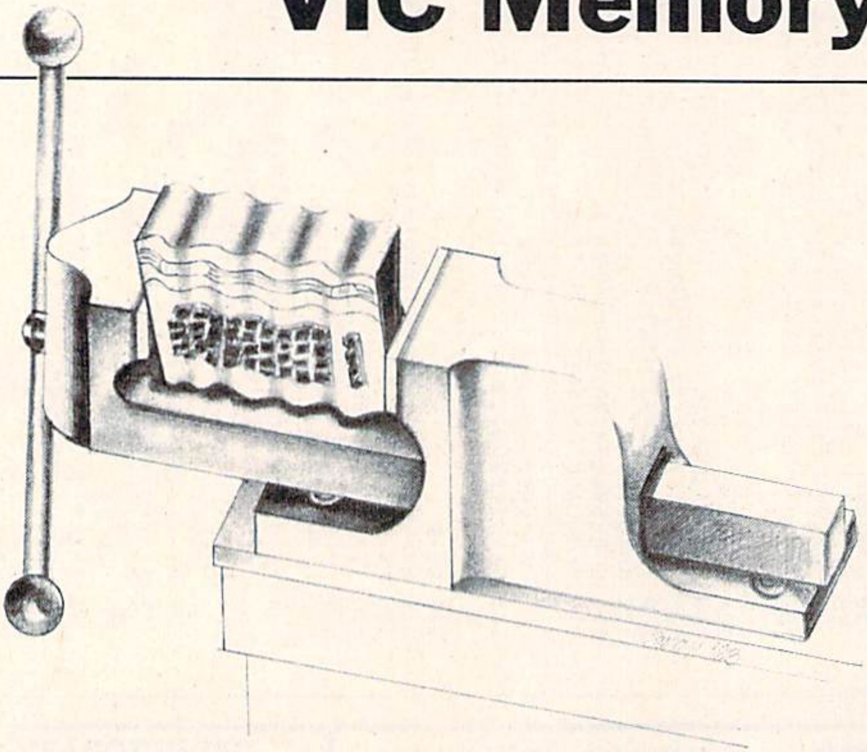

Come along and learn some techniques for squeezing the most out of your unexpanded VIC-20. Put the crunch on the memory crisis.

By Robert W. Baker

Address author correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

If you're using a Commodore 64 system, the available RAM space for writing your own Basic programs is generally adequate. However, a VIC-20 with no memory expansion can put a serious limit on what you can do.

Here are some tricks that may just let you squeak by. Eventually, you'll probably want to add extra memory, but even then these techniques will let you do "more with less."

The most obvious space-saving technique is to avoid using remarks in your program. This, however, makes the program harder to document, and if you should want to make changes later, it might take quite a while to remember what each variable is used for and how the program works. For safety's sake, while you're writing the program, you should make notes and save them.

The next best technique is to use multiple statements per line, with a separating colon. There's a five-byte overhead associated with every Basic program line, regardless of its length. These consist of two bytes for the line number (encoded in binary), two for a link address that points to the next sequential Basic line, and a single byte used as the end-of-line indicator. Whenever you combine two program lines on a single line, you save four bytes—the five-byte overhead less one byte for the required separating colon.

Just be careful; it's not always legal or correct to combine program lines. You might change the program flow or create part of a program line that might never get executed. Be especially careful around If...Then...and GOTO statements. Make sure the new program line still does what was intended.

Other Space-Savers

Another way to cut down on memory usage is to delete all unnecessary spaces from within your program. Commodore Basic does not need any separating spaces within program statements. Key words in Basic are stored as coded single-byte tokens when a program line is typed in. When the program is interpreted and executed, the tokens are easily identified by their unique codes. Separating spaces are simply ignored.

Although Basic key words are stored as single-byte tokens, all other text in a program line is stored just as it's typed, one character per byte. Thus, you can save additional space by using small line numbers and short variable names. By using line numbers 1, 2 and 3 instead of 1000, 2000 and 3000, you'll save three bytes on every GOTO or GOSUB involving these lines.

Also, don't forget to use variables to

all this...

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their fullest. Equate them to the value of commonly used constant values. This especially applies to strings. The string variable pointer will actually point to the text in the Basic program line where it's defined, instead of using variable space at the top of memory.

Try to reuse variables, too, wherever possible, rather than defining new variables every time you need to do some calculation. Remember, the less variable space you use, the more program space you'll have.

Avoid using arrays when simple variables will work just as well, because an array has more overhead (to allow for potentially much more data). If you have to use an array, be sure to declare its size and don't forget to use the zero element.

Watch the use of integer variables. Simple integer variables still take seven bytes each, whereas integer array elements save memory by using only two bytes per element. If you use a simple integer variable like K%, you'll actually waste space by using a percent sign each time you reference the variable. On the other hand, if this forces using INT(...) functions, you may be better off using the simple integer variable.

Don't forget, too, that Basic sets a default value for each variable the first time it is encountered in executing a program; strings are set to a null string and numeric variables are set to zero. There's no need to initialize variables to these values, since Basic does it for you.

Constants and Quotes

Constant data used by a program can be read into an array from an external data file on tape or disk, rather than from data statements within the program. Alternately, the data can be used directly from the data statements without being placed into an array, and can be reused any number of times by employing the Restore command.

You can also save space by omitting quotation marks around string element values in data statements. Quotes are only required if there are spaces or special characters like graphics, cursor controls, commas, colons and so on within the data.

Speaking of quotation marks, you can also omit closing quotation marks in any Print statement as long as it is not followed by other items to be printed in the same statement, or by a colon and another Basic statement. Basic will automatically add the closing quote and print the line.

Skip punctuation within multiple-item Print statements whenever possible. If you're printing variables separated by some text, such as

```
100 PRINT "LENGTH=";X;" WIDTH=";
Y;" AREA=";Z,
```

you could simply use

```
100 PRINT "LENGTH="X" WIDTH="Y"
AREA="Z
```

There's no need to use the separating semicolons, since Basic will automatically assume a semicolon separator between items.

Use TAB and SPC functions to avoid using extra spaces in Print statements. Just keep in mind that these functions actually move the cursor to the right the required number of spaces. You cannot use these functions to clear something from the screen, since a space character is not printed.

Also, always use subroutines to perform common functions needed at various points in the program. If you're going to need a yes/no answer from a user at various points in your program, then make a subroutine to do it, and call the subroutine whenever needed.

If you have nested For...Next loops with common exit points, then combine the Next statements:

```
100 FOR X=1 TO 10
110 FOR Y=10 TO 100
120 FOR Z=2 TO 4
•
•
•
200 NEXT Z,Y,X
```

Just be sure you get the variables listed in the correct order, and don't forget—the innermost loop will terminate first.

Finally, avoid using parentheses where they are not really needed for the proper interpretation of the statement. Remember the hierarchy of operations shown in the manuals.

I hope this information proves helpful in making your program fit into the available space. Generally, most of these space-saving techniques will also save execution time, so your programs may even run faster. 🅁

Space Saver Extraordinaire

By Robert Baker

Now...Time to Save Time

Now that you've learned how to save space when writing Basic programs, you are ready to learn how to save time, too. Keep in mind, though, that most of these time-saving techniques may also increase program size.

For starters, use variables instead of constants, since retrieving the value of a simple or array variable from the variable tables is faster than converting a constant from a program statement to its internal floating-point representation. For instance, if you're using the number 256 several times throughout your program, let P=256 and use the variable P wherever you would have used 256.

Order the definitions of variables carefully. Variables are defined in the internal variable table in the order they are encountered during execution of the program. Whenever the program references a variable, Basic must scan from the start of the variable table to find the desired value. Since those variables defined first can be located quickest, define most-often-used variables first. It may even be advantageous to define certain variables with dummy values at the start of the program to get them into the variable table in a specific order.

Define all simple variables before using a large array. Whenever you define a simple variable, Basic must move any existing arrays in memory to provide space for the new simple variable entry, and must modify accordingly all array pointers associated with that array.

Keep heavily used subroutines near

the start of the program and use a simple GOTO instruction to skip over them when the program begins. Basic normally searches from the start of the program to find the subroutine line, so placing subroutines near the end of the program wastes a great deal of time, especially if the subroutine is used for reading or writing data files.

Actually, Basic doesn't always have to scan from the start of the program to find the subroutine line. If the line number being called is at least 256 greater than the line calling the subroutine, then Basic will start scanning after the current line. This can still waste time, however, since the subroutine is not always close to the calling line.

Next—For You

Carefully examine the contents and structure of every For-Next loop, which is possibly the most notorious timewaster if not handled properly. Statements that do not need to be repeated for each iteration of the loop should be outside of the loop. If a value must be computed or a substring value used repeatedly within the loop, calculate the value once and define it as another variable that can be used as needed.

While on the subject of For-Next loops, remember not to use Next statements with the index variables. Next is somewhat faster than Next X because no check is made to see if the variable used is actually the same variable in the most recent For statement.

Another time-saving technique involves combining operations whenever possible in the normal program flow. If your program is going to read data into an array and then sort it, try to place the entry in the correct array position and shift the remaining entries accordingly as each item is read.

This is especially helpful when you manually enter the data from the keyboard. You may not notice a short delay between each entry, but later, when you have to sort an entire matrix, a long delay may be rather annoying.

As I said earlier, faster programs are not always smaller programs; there are usually trade-offs to be made. It's much faster to print the letter A 40 times with a single Print"AA...AA" statement than to use a For-Next loop like:

```
FOR X=1 TO 40; Print "A";: Next X
```

On the other hand, the For-Next loop does save quite a bit of memory space compared to the simple Print statement. It all depends on what you're trying to accomplish and which is more important: saving time or saving space. They sometimes can be complete opposites. Ⓡ

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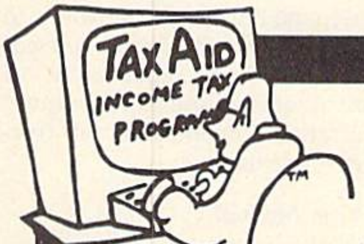

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Mystery of the Black Box Revealed

Are you in the dark about the mysterious black box called the 1541 single floppy disk drive? This illuminating article will shed some light on the subject and help you see your way clear to getting the most out of your disk drive.

By Louis F. Sander

Address author correspondence to Louis F. Sander, PO Box 15253, Pittsburgh, PA 15237.

Most computer beginners quickly learn the drawbacks of using cassettes to load and store programs, so disk drives soon appear on their shopping lists. The 1541 single floppy disk drive is a powerful and inexpensive addition to any VIC-20 or Commodore 64 system, but with the power comes frustrating complexity.

Simply reading the manual is no cure, because it's as complex as the disk drive, and thus far from friendly to beginners. My aim here is to present simple, step-by-step explanations of the most frequently used 1541 features and operations, oriented to the first-time disk drive user.

Open Your Manual . . .

With this article, your 1541 drive, user's manual and VIC 1541 Test Demo disk, you'll be able to master all the techniques of working with Basic programs on disk. You'll learn to unpack, connect and activate your disk drive, and to read disk directories. I'll show you how to load programs from prerecorded disks and how to save programs on blank ones.

Finally, you'll learn how to use the "wedge," or DOS support program, and how to use the 1541's built-in utilities for verifying, erasing and renaming programs on the disk. When you've finished reading, you'll know all about the most important disk operations, and you should understand the manual well enough to start learning about the others.

In whatever way you're involved in the world of electronics, you sooner or later learn the wisdom of that ancient proverb, "When all else fails, read the manual." Reading computer manuals will never be as easy as reading *Sports Illustrated*, but even the worst of them has most of what you need to know to work the equipment.

Your *VIC-1541 Single Floppy Disk User's Manual*, while far from perfect, is better than many equipment manuals, and it's the best all-in-one source of information about the 1541. I'm assuming that you have a manual to refer to while you're reading this article, so I'll try to avoid repeating information that's already in the book.

My own manual is identified on its title page as P/N 1540031-02, and on the copyright page as Second edition, December 1982. If yours is different, don't worry; you'll still be able to follow the train of thought.

Get your own manual out now, and look carefully at the table of contents on page 1. We'll be taking a guided tour through the material in chapters 1–4, but doing it in a more understandable sequence and adding some important explanations. The advanced material in chapters 5–9 is beyond our scope right now.

Speed and Capacity

Look first at chapter 1, which gives an excellent background for understanding this article and the rest of the manual. When they say your disk is fast, they aren't kidding. I timed a 64K program as it first loaded from tape and then from the 1541, with these results: tape, 311 seconds; disk, 45 seconds. Not bad! There *are* faster disks than the 1541, though; my PEDISK II loaded the same program in four seconds flat. Nevertheless, your

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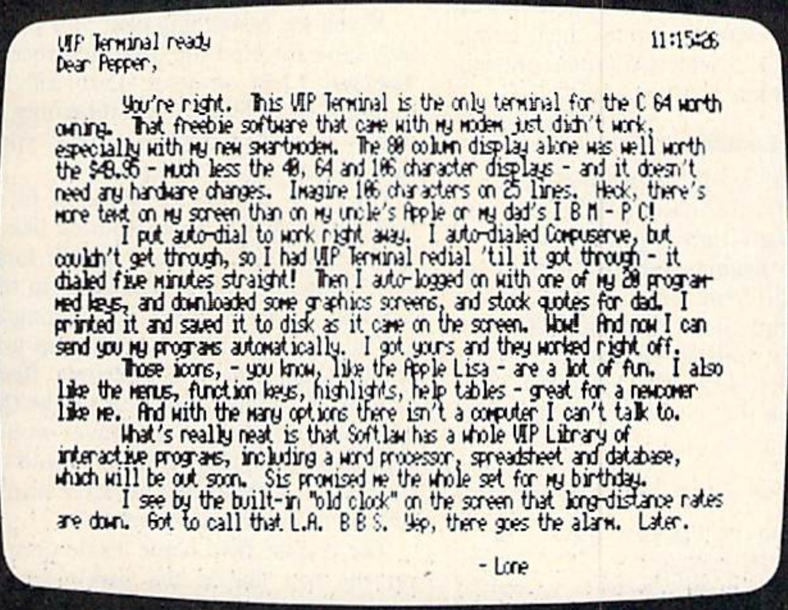

```
VIP Terminal ready                                              11:15:26
Dear Pepper,

        You're right.  This VIP Terminal is the only terminal for the C 64 worth
owning.  That freebie software that came with my modem just didn't work,
especially with my new smartmodem.  The 80 column display alone was well worth
the $49.95 - much less the 40, 64 and 106 character displays - and it doesn't
need any hardware changes.  Imagine 106 characters on 25 lines.  Heck, there's
more text on my screen than on my uncle's Apple or my dad's I B M - P C!
        I put auto-dial to work right away.  I auto-dialed Compuserve, but
couldn't get through, so I had VIP Terminal redial 'til it got through - it
dialed five minutes straight!  Then I auto-logged on with one of my 20 program-
med keys, and downloaded some graphics screens, and stock quotes for dad.  I
printed it and saved it to disk as it came on the screen.  Wow!  And now I can
send you my programs automatically.  I got yours and they worked right off.
        Those icons, - you know, like the Apple Lisa - are a lot of fun.  I also
like the menus, function keys, highlights, help tables - great for a newcomer
like me.  And with the many options there isn't a computer I can't talk to.
        What's really neat is that Softlaw has a whole VIP Library of
interactive programs, including a word processor, spreadsheet and database,
which will be out soon.  Sis promised me the whole set for my birthday.
        I see by the built-in "old clock" on the screen that long-distance rates
are down.  Got to call that L.A.  B B S.  Yep, there goes the alarm.  Later.

                                   - Lone
```

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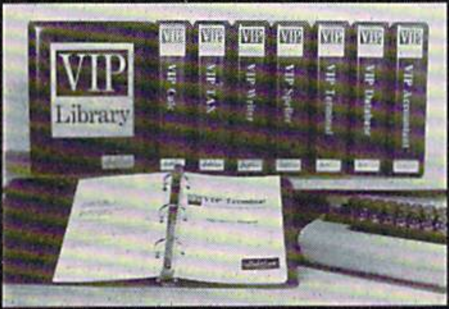

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AUTHOR'S SUBMISSIONS ARE ENCOURAGED.

1541 is a big improvement over your Datassette.

Only three of the specifications on page 5 are of direct interest to the beginner—one on media and two on storage. The 1541 uses standard soft-sectored, single-sided, single-density disks. That's good news, since those are usually the least expensive. You *can* use other types of disks, but you'll be paying money for quality your 1541 cannot use.

The capacity of a disk has definite limits. You can put up to 144 programs on one disk, as long as they occupy fewer than 174,848 bytes. As soon as that number of bytes is recorded, that disk is full, even if only a few programs are on it. If you attempt to save a program that exceeds either limit, the 1541 will send you an error message.

Unpacking and Connecting

Chapter 2 of the manual does a good job of explaining how to unpack and connect the drive, but it contains a few errors and omissions, mostly connected with the LEDs (light emitting diodes) on the 1541's front panel. The green LED is nothing more than a pilot light; it's on whenever there's power to the drive. The red LED has two purposes: it goes on whenever data is being read from or written to the disk, and it flashes whenever a disk error has occurred. (We'll talk about disk errors later on.)

When reading or writing, the red LED works in conjunction with the disk drive motor, as you can hear if you listen carefully. The motor often starts a second or so before the red LED comes on, and continues to run for a moment after the red LED goes off.

The manual incorrectly states that the *green* LED blinks during power up; it's really the *red* one that blinks. The manual also cautions against removing a disk when the *green* LED is on, and that's another misprint. Never remove or insert a disk when the *red* LED light is on. You should make both of these corrections on page 8.

Two other corrections do not apply to LEDs. If you have a master power switch that turns all your equipment on at once, you can disregard the instruction about turning the computer on last. It's there to insure that all peripherals are on during the computer's power up cycle, which takes a second or so to run. If the 1541 goes on at the same time as the computer, everything will be fine. Finally, change the word "seitch" at the top of page 9 to "switch."

Now that you have the background to understand the corrected chapter 2, read it and follow its instructions carefully. Pay special attention to the section entitled Insertion of Diskette, to learn the proper orientation of the disk in the drive. The special commands on page 9 are sent by typing them (while the 1541 is connected), then pressing the return key.

Program Loading

Chapter 3 of the manual holds a wealth of information, but you may have a hard time digging it out. To make the digging easier, we'll take topics in a different sequence and explain some things that the manual doesn't. First, let's look at the programs on a prerecorded disk—the VIC 1541 Test/Demo disk that comes with your 1541.

```
0     "1541TEST/DEMO"  ZX      2A
13    "HOW TO USE"             PRG
5     "HOW PART TWO"           PRG
4     "VIC-20 WEDGE"           PRG
1     "C-64 WEDGE"             PRG
4     "DOS 5.1"                PRG
11    "COPY/ALL"               PRG
9     "PRINTER TEST"           PRG
4     "DISK ADDR CHANGE"       PRG
4     "DIR"                    PRG
6     "VIEW BAM"               PRG
4     "CHECK DISK"             PRG
14    "DISPLAY T&S"            PRG
9     "PERFORMANCE TEST"       PRG
5     "SEQUENTIAL FILE"        PRG
13    "RANDOM FILE"            PRG
558   BLOCKS FREE.
```

Fig. 1. Screen display of the Test/Demo disk directory.

If you followed the instructions in chapter 2, your computer and disk drive should both be on, awaiting your next command. Following page 8's instructions for inserting the disk, put the Test/Demo disk into your drive and close the door.

As it comes from the factory, Test/Demo has several programs recorded on it, along with a directory. In fact, every disk gets a directory as part of setting it up to work on a Commodore drive. The directory tells what, if anything, is recorded on the disk, and reading it is an important and frequent operation.

The directory can be loaded into memory and listed, just like a Basic program. To load a directory from disk, type LOAD, followed by a dollar sign in quotes, a comma and the number 8. Then press the return key. So, with Test/Demo in the drive, type

```
LOAD "$",8
```

Then press the return key, and you should get a loading message, followed in a few seconds by a Ready prompt.

If you get something else, you probably have inserted the disk incorrectly. The red LED on your 1541 will be blinking to indicate that something is wrong. If that happens, check your disk and try the Load again.

Once "$" has loaded properly, list it and notice that it looks nothing like a normal Basic program; it should look something like Fig. 1. The items in the directory have the following meanings.

The zero at the start of the top line shows that this is a directory from drive 0. If you had a dual drive like the 4040 or 8050, one of the drives would be numbered 0, and the other would be numbered 1; this first character would differentiate their directories.

The reverse field name inside quotes on the top line is the disk's name, which was assigned when the disk was set up for a Commodore drive. Like program names, this one can have a maximum of 16 characters.

The ZX on the top line is this disk's two-character ID, which was established at the time the disk was named. A disk's name and ID are completely independent ways of identifying it. Unlike the name, the ID is recorded many times on the disk and is intimately involved in the 1541's operations. As much as possible, you should avoid assigning the same ID to more than one disk.

The 2A that ends the top line indicates the Disk Operating System (DOS) version under which this disk was named. If you don't know what that means, don't worry—you can get along fine for now without knowing.

The next lines in the directory contain information about the 15 programs recorded on the disk. The number at the start of each line is the number of "blocks" a given program occupies on the disk, and it is a rough indicator of the program's length. You can see that How to Use is a much longer program than C-64 Wedge.

Program names, 16 characters maximum, appear in quotes following the block indicators. The letters PRG following the program name indicate that the material recorded is a program, as opposed to a data file. Different letters, such as SEQ or REL, are used to indicate data files of different types.

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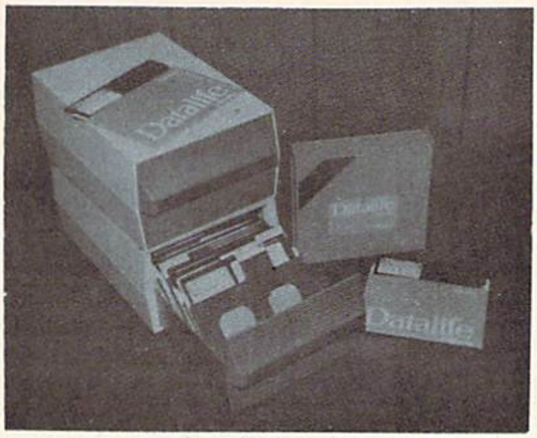

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Strictly speaking, what we have called program names should be called file names, since, to the 1541, a program is just another type of file.

As you use your directories in the future, you'll see that new programs added to a disk don't always appear at the end of the directory, but that they're sometimes inserted in the middle. That's because the 1541 puts programs wherever it finds disk space, which can be anywhere on the disk. The directory lists them in whatever order it finds them, which is sometimes confusing.

The bottom line of the directory tells how many blocks of storage remain on this disk. As programs are added, this number will decrease, and as they are erased, it will increase.

To find the names of the programs recorded on any disk, you load and list its directory, just as we have done for the Test/Demo disk. The next step is usually to load one of those programs by entering

```
LOAD"xxxx",8
```

where xxxx is the name of the desired program, typed in all caps.

There are some useful fine points and shortcuts in loading programs from disk, and they are covered nicely in your manual. Now read the first four pages of chapter 3 to learn about them. Stop when you get to the Save command at the bottom of page 12, since we have work to do before getting into saving; then return to this article.

Now that you've read about loading programs from disk, let's do it. The Test/Demo disk contains over a dozen disk utility programs that are likely to be useful to you in the future. The first two programs on the disk contain brief instructions for using the others.

First, load the program named How to Use by entering the command LOAD"H*",8. (If you read the manual, you know about using an asterisk to activate the pattern-matching option.)

Now run the program and read the descriptions of the others, but don't load any of them at this time. When you press the space bar, be sure to release it quickly, or its repeating action will skip past some important information.

When you get to the end of the program, the command LOAD"HOW PART TWO",8 will be on the same line as the cursor. Press the return key to execute it, and watch the red LED on your disk drive while listening for the motor—they'll do just what we said they would. Now run the program you just loaded and read about the final programs on the disk.

That finishes our loading homework. For your convenience, the instructions from the How to Use programs are outlined in Table 1, and listings of some of them appear in Appendix C of the manual. Now we're ready to save things onto the disk.

Saving Onto the Disk

When you bring a blank disk home from the store, it is *completely* blank. Before it can be used, it must be given a name and two-character ID, and some of its space must be set aside for a directory. This activity is often called formatting the disk, and it is done by entering a series of keyboard commands.

These commands are described on pages 14 and 15 in chapter 4 of the manual, under the headings Open and Print# and New. These descriptions make it clear that you can format a blank disk by inserting it into the 1541 and then entering OPEN15,8,15, "NEW0:BILLY,BS".

The disk thus formatted will be named BILLY, and its ID will be BS. If you have a blank disk, try formatting it right now. Then load and list its directory to prove your accomplishment.

Since formatting involves writing to the disk, the write-protect notch must not be covered when you attempt it. (The write-protect notch is the ¼-inch square cutout in the edge of the disk that, when covered with tape, prevents any writing to the disk.) If you try writing to a protected disk, the red LED will start to flash, indicating an error condition.

Saving a Basic program to a formatted disk is simplicity itself. All you do is enter

```
SAVE"xxxx",8
```

where xxxx is the desired program name. As with Load, there are fine points to be understood, and these are covered under Save and Save and Replace on pages 12 and 13 of the manual.

The Verify command, so useful with the Datassette, also is available for disk. But disk recording is much more reliable than cassette recording, so Verify is much less often used with disks. Verify is explained on page 13 of the manual.

Other Disk Commands

The OPEN15,8,15 command you used when formatting a disk has more to it than meets the eye. Channel 15 is the so-called command channel or error channel, and it can be used for sending many different commands to the 1541. You open it by entering OPEN n,8,15, where n, the logical file number, is any number from 1 to 127. Most people make n = 15 to avoid confusion.

Table 1. Instructions from the How to Use programs on the Test/Demo disk.

Disk Instructions

Additional commands are available that allow you to type short instructions to the disk drive. Load and run the VIC-20 Wedge if you have a VIC; use the C-64 Wedge if you have a Commodore 64.

To load a program, you will now be able to type a backslash, followed by the program name. The / means load from disk drive. For example, type /MILEAGE to load a program called Mileage.

Type > or @ to display the current error status. Type >$ or @$ to display the directory without erasing the current program.

Copy/All Program

The Copy/All program, written by Jim Butterfield, can be used to copy files from one drive to another if the drives are connected to the same computer. It is necessary first to change the device number of one drive from 8 to 9, by using the Disk ADDR Change program.

Load and run the Disk ADDR Change program, following the prompts; then proceed to load and run Copy/All. This will let you copy from unit 8, drive 0 (the unchanged drive) to unit 9, drive 0 (the drive just changed).

The disk you are copying to must not have the write-protect notch covered, and it is a good idea to put a piece of tape over the write-protect notch on the disk to be copied.

Printer Test

The Printer Test prints a listing of the characters in a format that allows easy checking of the mechanical and electronic capabilities of the printer.

View BAM

The View BAM program allows a programmer to examine the contents of

The command channel can be closed in many different ways, some of them quite subtle, and closing it unintentionally can make you think your computer has gone haywire. The Basic statements Close, CLR, New and Run will close the command channel, as will adding or deleting any Basic program lines. No doubt there are other ways too. The point is that an open channel can close unexpectedly, and you should be prepared for that to happen.

When a command channel is open, commands are sent to the 1541 by entering PRINT#15,xxxx, where xxxx is the command in question. (If the channel has been opened with a logical file number other than 15, *that* number, rather than 15, needs to follow the Print# command.)

Most of the commands consist of a word or its abbreviation, some punctuation and some other parameters. The commands of greatest interest to beginners are Scratch, to erase a program from the disk, and Rename, to give a program a new name.

Initialize and Validate may also be of some interest. These commands and more are explained on pages 16–18 of the manual.

Errors and Error Messages

The many error conditions that can blink your red LED are listed in Appendix B of the manual. There are read errors, write errors, syntax errors and more. If you're interested, now is the time to leaf through Appendix B and see them all.

Whenever the red LED is blinking, information about the error that caused it is available on the command channel. In fact, that channel is sometimes called the error channel. By writing and running a short program, you can read the error information, which is often useful in diagnosis. The details are presented on page 18 of your manual, in the section entitled Reading the Error Channel.

Once the red LED starts blinking, it continues until the error channel is read or until some other event terminates the error condition. Typically, such events are turning the computer off and back on, loading a program from disk or loading the disk's directory into memory.

The Wedge

The DOS support program, also called the "wedge," is one of the most useful, but also most poorly documented, programs in all of Commodore land. Its purpose is to eliminate many of the keystrokes usually needed to work with disk drives, and it serves that purpose well. Your Test/Demo disk probably contains a wedge for your computer. On my disk there are two—VIC 20 Wedge and C-64 Wedge. Yours may have them with slightly different names, but they are probabl there.

Once you load and run the wedge, you can load other programs just by typing a slash mark and the program name, then pressing the return key. The program name need not be enclosed in quotes, and the asterisk or question mark can be used in the normal manner to abbreviate it.

The wedge lets you read the error channel just by typing > or @, and then pressing the return key. If you follow either symbol with a dollar sign, the directory will be displayed on the screen without disturbing any program already in memory. Also, either symbol will take the place of PRINT# in using the command channel, with no need for opening the channel itself!

You can read about the wedge under DOS Support Program on page 14 of the manual and in the output from the How to Use program. Some versions of the wedge have more commands than are listed in the book. Covering them all here is beyond our scope, but if you ask a more experienced 1541 user, he or she may be able to fill you in.

Most experienced disk drive users use the wedge extensively and seldom try the longer commands. You can do this too, if you wish. We saved the wedge until the end of our story, mainly so you'd get a good understanding of 1541 operations before taking shortcuts, and also because not every 1541 owner has a copy of the wedge for his machine.

By the way, the origin of the term wedge is shrouded in mystery. Some say the unusual name comes from the shape of the "greater than" symbol used to evoke the program, while others say it comes from the way new commands are "wedged" into the Basic interpreter. But I have it on good authority that both of those are wrong. Like so many computer words, this one is an acronym. Why the word wedge? We Experts Don't Give Explanations!

Now that you've seen all the elementary 1541 operations and have read chapters 1–4 of the user's manual, you should have a pretty good grip on working with your new disk drive. As we hinted earlier, though, you've just scratched the surface of all the 1541's capabilities.

Chapters 5–9 of the manual hold the keys to the rest of the things you can do. After you've worked with your 1541 for a while, you might want to dig into them and see what you can use. R

the sectors that make up the block availability map, or BAM. The BAM is the table that the DOS uses to identify the blocks that have been allocated to the files on that disk.

Display T & S

The Display T & S program allows a programmer to examine the contents of a block by specifying the particular track and sector numbers that identify that block.

Check Disk

The Check Disk program can be used to make sure that a new disk that has been headered is in fact a good disk. The program writes to every block to verify its ability to store information. The program also will identify and allocate any bad blocks in the BAM to prevent them from being used by the DOS at a later time.

Press the return key to load part two. After it loads, type RUN, press the return key and type LOAD"HOW PART TWO",8.

Performance Test

The Performance Test program allows you to test the electronic and mechanical capabilities of the disk drive whenever necessary. Use this program whenever you suspect that there may be damage to the drive.

Sequential File and Random File

These two disks are included as programming examples that you can use as guidelines when writing your own programs. They also illustrate the important technique of checking the error channel after each access to the disk drive.

Because of their size, Sequential File and Random File both require the 3K expansion cartridge to load properly on the VIC-20.

The DOS 5.1 program is not intended to be loaded directly, but is loaded instead from the C-64 Wedge program.

Triple Power Play

Octal–Decimal–Hex

Are you a programmer who's all thumbs when it comes to manipulating number bases? You'll never make an error with this triple play combination—hex to octal to decimal. All you need are a pocket calculator and some numbers to field.

By Neal D. Atkins

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You're working on a super new program and you realize you must find the decimal equivalent of C37F hex. You can't find your conversion tables and you don't have a TI or HP programmer's calculator. All you have is your kid's $4.98 four-function calculator. Can this cheap little machine really be used for hex conversion? Yes, with just a few simple operations, you can quickly and easily convert hex and octal to decimal and vice versa. The conversion methods take longer to explain than to do.

Octal to Decimal (See Example 1)

STEP 1 Enter the left-most digit.
2 Multiply by 8.
3 Add the next digit to the total.
4 Stop if there are no more digits.
5 Else repeat step 2.

Example 1: convert 7236 octal into decimal

Operation	Display
7×8	56
+2	58
×8	464
+3	467
×8	3736
+6	3742

Answer: 7236 octal = 3742 decimal

Example 2: Convert C37F hex into decimal

Operation	Display
12×16	192
+ 3	195
×16	3120
+ 7	3127
×16	50032
+15	50047

Answer: C37F hex = 50047 decimal

Hex to Decimal (See Example 2)

The technique is identical to the octal conversion, with the exception that you multiply by 16 rather than by 8. Also, when keying in hex letters A–F, you enter their decimal equivalents. If you don't remember them, you can refer to Table 2.

Decimal to Octal (See Example 3)

Conversion from decimal to octal involves division by 8 and then writing down the remainder. When performing this operation on a calculator, the remainder is displayed as a decimal fraction. Table 1 shows the decimal fractions you can get when dividing by 8, with the equivalent number of 8ths shown in the "octal" column. Again, the method takes longer to explain than to perform.

STEP 1 Enter the decimal number to be converted.
2 Divide by 8.
3 Using the fractional portion of the result, find the corresponding remainder in 8ths from Table 1. Write down this digit (to the *left* of any

Example 3: convert 3742 decimal into octal

Operation	Display	From Table 1
3742÷8	467.750	.750
−.750	467.000	
÷8	58.375	.375
−.375	58.000	
÷8	7.250	.250
−.250	7.000	
÷8	0.875	.875

Answer: 3742 decimal = 7236 octal

digits written from previous steps).

4. Subtract the fractional portion from the result of step 2.
5. Stop when the integer portion becomes zero.
6. Else go to step 2 and repeat the process.

Decimal to Hex (See Example 4)

The conversion from decimal to hex is identical to the conversion of decimal to octal, with the exceptions that you divide by 16 and look up the remainders in Table 2.

The elegance of these methods is in their simplicity. Even if you don't have Tables 1 and 2, as long as you have a calculator on hand, you can do these conversions. The tables can quickly be generated by dividing every integer from 1 to 7 by 8 for the octal table, and every integer from 1 to 15 by 16 for the hex table.

One word of caution: When using any method, certain calculators will not do chained operations. If this is the case, you must press the equals key after entering an operation. Whether or not your calculator performs chained operations can easily be determined by entering the following:

8+1×2+ 18

If you don't come up with 18, then try:

8+1=×2+ 18

If this gives the correct result of 18, then press the equals key after each addition.

Example 4: Convert 50047 decimal into hex

Operation	Display	From Table 2
50047 ÷ 16	3127.9375	.9375
−.9375	3127.0000	
÷ 16	195.4375	.4375
−.4375	195.0000	
÷ 16	12.1875	.1875
−.1875	12.0000	
÷ 16	0.7500	.7500

Answer: 50047 decimal = C37F hex

Decimal to Binary (See Example 5)

The easiest method for converting decimal to binary is first to convert the number to octal or hex; then write down the binary pattern of 0s and 1s for each digit. If you can't remember the binary patterns, they can be found in Tables 1 and 2.

To go from binary to decimal, start at the right and separate the binary digits into groups of three. Using Table 1, write down each octal equivalent. Then, using your calculator, apply the method for octal to decimal conversion.

Now that you have learned these simple techniques, you can find that decimal equivalent you were searching for and finish your super program. Ⓡ

Fraction	Octal	Binary
.000	0	000
.125	1	001
.250	2	010
.375	3	011
.500	4	100
.625	5	101
.750	6	110
.875	7	111

Table 1. Decimal fractions from ⅛ to ⅞, with their octal and binary digit equivalents.

Example 5: convert 3742 decimal into binary

First convert 3742 to octal, getting 7236 (Example 3). Then, substitute the binary values for each digit of 7236:

7	2	3	6	octal
111	010	011	110	binary

Fraction	Hex	Dec.	Binary
.0000	0	0	0000
.0625	1	1	0001
.1250	2	2	0010
.1875	3	3	0011
.2500	4	4	0100
.3125	5	5	0101
.3750	6	6	0110
.4375	7	7	0111
.5000	8	8	1000
.5625	9	9	1001
.6250	A	10	1010
.6875	B	11	1011
.7500	C	12	1100
.8125	D	13	1101
.8750	E	14	1110
.9375	F	15	1111

Table 2. Decimal fractions from 1/16 to 15/16, with their hexadecimal, decimal and binary digit equivalents.

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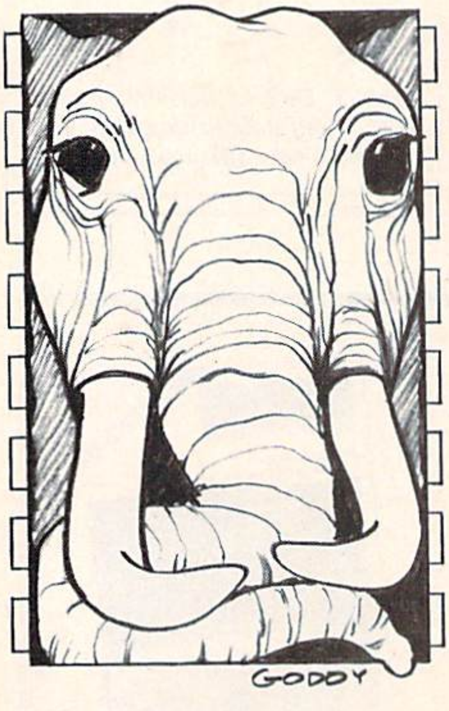
Tips You'll Never Forget

Your unexpanded VIC-20 may have a better memory than you imagine. Try these tips to make that little 3.5K go farther.

By Joseph H. Leonard



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Your VIC-20 is a great little computer. The only problem seems to be that word "little." The unexpanded VIC-20, ostensibly with 5K of memory, actually has only 3583 bytes that you can use for programs and data. The rest of the memory is used by the Basic operating system and the screen. There doesn't seem to be much room left.

Many articles have appeared that explain how you can condense programs to squeeze more Basic statements into a small space. This article will explain how the VIC-20 stores its data internally and will offer some suggestions on using data to save space.

Data Storage

Data comes in many forms. Basically there are three types: strings, integers and floating-point numbers. Some data may be used to display messages on the screen, some is held by the program to help it make decisions, and other data is needed to do calculations.

Normally, data is stored either as a constant or as a variable. An example is 10 POKE36878,15, where 36878 is the memory location that controls the sound volume, and 15 is the loudness of the sound. The value 36878 is constant, whereas the 15 might vary in your program, depending on the loudness desired.

When you type 10 POKE36878,15 as a Basic statement, you will need 13 bytes of memory. The line number and internal link (see p. 120 of *VIC-20 Programmer's Reference Guide*) take four bytes. The word Poke is tokenized into a 1-byte symbol, and the numbers and the comma take eight bytes.

If you set the volume only once in your program, it will not pay to use a variable to save memory. However, if your program calls for changes in volume, then you can type

```
10 V=36878
20 POKEV,15
```

You will then save four bytes every time you set the volume. In general, if you plan to use any constant many times, it is a good idea to replace it with a variable.

But this is a very imprecise rule. Adding line 10 as above takes some bytes, too. The line number and link take four bytes and the V=36878 will take seven bytes. But there will be an additional seven bytes needed by the VIC to store a "header" that contains information about the variable V.

Variable Types

Variable V is a floating-point number. All header information is stored right after the end of the last line in your Basic program. This area's location will vary, depending on the size of your program. You can find where it is by typing PRINT PEEK(46)*256+PEEK(45). These 7 bytes are described in Table 1.

The first character of the variable V has an ASCII value of 86 (see the user's manual, p. 146). There is no second character. The rest of the number fits into the remaining bytes. Byte 5 is the binary exponent plus 129. The first bit of byte 4 holds the sign (0=positive; 1=negative). Therefore, 14 bytes are used to hold the floating-point variable for line 10.

At times, you may wish to use an integer variable instead of a floating-point variable. You cannot use a value greater than 255, so memory location

Byte	Description	Decimal	Hex
7	1st character of variable name	86	56
6	2nd character of variable name	0	00
5	binary exponent + 129	144	90
4	mantissa in packed Binary Coded Decimal	16	10
3	mantissa in packed Binary Coded Decimal	14	0E
2	mantissa in packed Binary Coded Decimal	0	00
1	mantissa in packed Binary Coded Decimal	0	00

Table 1. Header information for floating-point variable V.

Byte	Description	Decimal	Hex
7	1st character of variable name + 128	214	D6
6	2nd character of variable name + 128	128	80
5	high order of number in binary	00	00
4	low order of number in binary	15	0F
3	not used	0	00
2	not used	0	00
1	not used	0	00

Table 2. Header information for integer variable V.

36878 cannot be an integer. But you could make the volume an integer by typing

```
10 V=36878:V%=15
20 POKEV,V%
```

A header of seven bytes will still be needed. Integer data is stored as shown in Table 2.

Even though bytes 3, 2 and 1 are not used, they will always contain zeros; so you still need seven bytes for the header. I have read elsewhere that you can save space by using integers, because they take only four bytes, while floating-point numbers need seven. This is not true. They both take up seven bytes. In fact, you will lose one byte in your program lines for each % you have!

It is not always necessary to use integer or floating-point numbers for data. Strings can be used, and they take up less space in some cases. For example, if your first program were written

```
10 V$="36878"
20 POKEVAL(V$),15
```

then you'd have a different arrangement of data storage.

Line 10 will require 14 bytes. There are four bytes in the line number and link. Then you have ten bytes for the rest of the line. You will still need a 7-byte header. (See Table 3.)

Avoid integers and strings as numbers. Use floating-point variables for constants.

Note what has happened. The string is stored in memory location 4105 (PRINT 16*256+9). Since the Basic program begins at location 4097 and ends at 4127 (PRINT PEEK(46)*256 +PEEK(45)), you can see that the data is stored inside the program itself.

Byte	Description	Decimal	Hex
7	1st character of variable name	86	56
6	2nd character of variable name + 128	128	80
5	number of characters in string	5	05
4	low order address where string is stored	9	09
3	high order address where string is stored	16	10
2	not used	0	00
1	not used	0	00

Table 3. Header information for a string variable.

Byte	Description	Decimal	Hex
7	1st character of variable name	67	43
6	2nd character of variable name + 128	128	80
5	number of characters in string	10	0A
4	low order address where string is stored	241	F1
3	high order address where string is stored	29	1D
2	not used	0	00
1	not used	0	00

Table 4. Header information for example of improper use of string variable, resulting in excess use of memory.

So which method do you use? To save bytes of memory, you should avoid integers, as they cost one byte for every % you type. You should also avoid strings when they represent numbers, as you need two bytes for the " plus one byte for each $. Use a floating-point variable for a constant often employed.

Other Space Savers

If you have a lot of variables and data in a program, you don't have to define them all in one program. Divide your program in two. Program One defines the variables; Program Two uses them.

```
Program One
10 V=36878
20 LOAD
Program Two
10 POKEV,15
```

Program One defines variable V as the location for the volume. Then it calls and runs Program Two, which turns on the volume. You'll save the 11 bytes it takes to define V. (This will only work, of course, if Program Two is not greater than Program One!)

You can save even more memory by asking the user for the value of a variable in Program One and then putting it in a "safe" place where Program

Two can use it. For example,

Program One Old

```
10 INPUT"HOW MANY PLAYERS";A$:A=
VAL(A$)
```

This line takes 46 bytes. There are four bytes in the line number and link. INPUT takes one byte. The words take 18 bytes. A$ requires two bytes in the program, then seven bytes for a header. The : needs one byte. The variable A takes one byte plus a 7-byte header. Add six bytes for the rest.

You would probably need 46 bytes for each question. Then think of the bytes you need for instructions. Let's pull all this into our new Program One.

Program One New

```
10 PRINT"Instructions........"
.
.
.
20 INPUT"HOW MANY PLAYERS";A$:A=
VAL(A$)
30 POKE251,A
40 LOAD
```

Memory locations 251 to 255 are "safe" locations. Anything put there will stay there. (Don't use the cassette buffer locations, as all data will disappear as soon as you load the next program.)

Program Two

```
10 A=PEEK(251)
```

Another technique is to store data on cassette tape. Then, as you need the data, read it from tape. (Don't read the data into an array—we are trying to save memory.) Read one line of instructions and display it on the screen; then read another, display it, and so on. You could even store data and screen images on tape.

> *These tips will save you memory, not make your programs run faster.*

When you are using string variables, you must be careful not to concatenate them in the wrong way. If you do, you'll lose a lot of memory space.

```
10 A$="CITY":B$="STATE"
20 C$=A$+","+B$
30 PRINTC$
```

This program is trying to print the words CITY,STATE, but by using C$, you're going to take 18 bytes more. (See Table 4.)

The string is being stored in location 7665 (PRINT 29*256+241). This is not in the program area. So, in addition to the memory bytes line 20 is taking (16 plus a 7-byte header), you have 10 more bytes of memory used at 7665. This is now 33 bytes. It would be better to rewrite this program as

```
10 A$="CITY":B$="STATE"
30 PRINTA$","B$
```

You need five more bytes in line 30, but you save 33 bytes elsewhere.

Summary

To sum up, you can gain more memory in your unexpanded VIC-20 by a careful analysis of the type of data structure you are using and where you are storing it, by employing more than one program and by avoiding improper string manipulation. These techniques won't make your programs run faster or help you to understand the logic involved, but they *will* save you memory. ®

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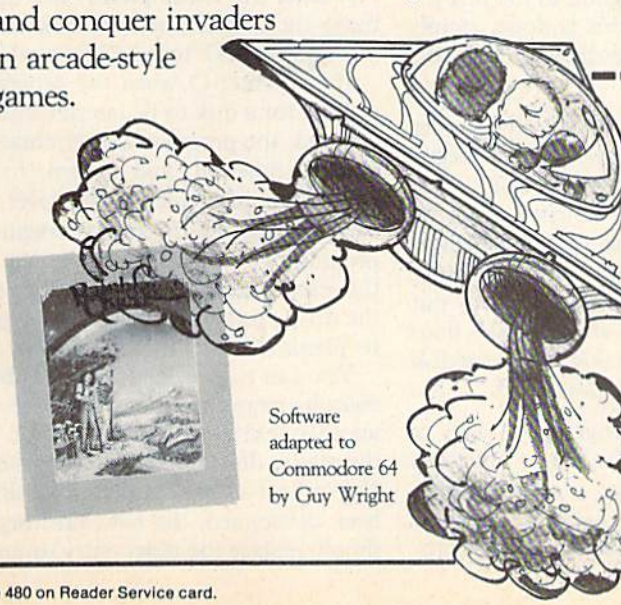

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Disk Master Revisited

What's more aggravating than having a disk full of information but not being able to readily access your files? Get back in control with this program that shows you what files you've got and where.

By Robert Baker

RUN It Right
Commodore 64
1540, 1541, or other disk drive
Commodore printer optional

Address author correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

Disk Master is a program designed to catalog a number of disks to form a large master directory on a single disk. The program automatically reads the directory blocks of any desired disk and writes a condensed directory file on the master directory disk.

It also maintains a cross-reference file to record the relationships between disk IDs and disk names. In addition, Disk Master provides several utility functions for locating specific files, displaying individual directories, listing the disk IDs currently in use, and so on.

The original version of Disk Master for the PET and CBM systems was published in the June 1982 issue of *Microcomputing* magazine. I have modified this version for the Commodore 64 to run with a single VIC-1541 disk drive, but it still provides all the original features.

Using the Program

To use the program, you first format a blank disk to become the master directory disk. Then, for convenience, copy the Disk Master program as the first file on the disk. Once this is done, simply insert the disk in the drive and run the program.

That's all there is to it. Disk Master will create and maintain all necessary files on the master directory disk.

For the program to function properly, you must always place the master directory disk in the drive when Disk Master is started. I'd suggest that you not put any other programs on this disk, since the program assumes that the entire disk is available for storing directories.

Whenever the program is run, a menu identifies the five major functions available. To perform a specific function, simply enter the indicated number. Entering zero will terminate the program and return you to Basic. I'll describe the other functions in detail.

Function Details

1—*Update master directory.* When you select this function, you remove the master directory disk from the drive and insert the disk you want catalogued. Then you press any key on the keyboard.

The program will display the disk ID and name as read from the disk and then wait for verification that the correct disk was actually inserted. If N is entered, the program will wait for another disk to be inserted. After a Y response, the program will proceed to read the disk directory and sort the filenames found into alphabetical order.

If the disk ID has already been catalogued, but with a different disk name, a warning message will be displayed. You then can either abort or continue the catalog update function. If everything is OK, the program will ask you to insert the master directory disk back in the drive and press any key when ready.

Disk Master will then update the master directory and the cross-reference file. Once this is completed, you can remove the master directory disk and insert another disk to be catalogued.

If you enter Q when the program is waiting for a disk to be inserted and catalogued, the program will terminate the update function and return to the master function menu. However, before redisplaying the master menu, the program will remind you to make sure the master directory disk is inserted in the drive, and it will wait for any key to be pressed before processing.

You can easily catalog any number of disks by merely inserting them one after another, but always in alternation with the master directory disk to save the catalog information. If a disk has already been catalogued, the new directory will simply replace the older entry to update the master directory.

2—Delete disk entry from master. This function allows you to remove a particular disk completely from the master directory. It performs all necessary housekeeping by deleting the appropriate data file and the disk entry in the cross-reference list of disk IDs and names.

This should be the only method used to remove an entry from the master directory. Do *not* try to delete the data file on the master directory disk manually. The individual directory files are named by "DIR." plus the two-character ID for the corresponding disk.

The disk to be deleted is identified by its disk ID or by its name. A cross-reference of disk IDs and names exists so that you can specify either. To enter the disk name instead of the ID, press the return key alone for the disk ID and then enter the desired disk name.

You can even use an asterisk at the end of the disk name to indicate character-matching on the characters entered. The program will display a disk name and ID, then check to see if they are correct. If the response is N, and you used an asterisk for character-matching, the next ID entry in the cross-reference list will be displayed.

This lets you search quickly for the desired disk if you can't remember the ID or full disk name. If you enter only an asterisk for the disk name, the program will automatically step through the entire list of disks until you indicate the correct one is found.

Pressing the return key alone for the disk name will end the function and return you to the master function menu. If you enter a disk ID or name that does not exist in the master directory, an error message will be displayed. Simply press any key to continue; then enter another disk ID or name.

3—Display selected directory. This function displays or prints the directory of any disk that has been catalogued. The specific disk must be identified by its ID or name in the same manner as in the delete function. Once the correct disk is found, the disk directory displayed or printed will indicate:

- the disk name, ID and format
- the number of blocks free
- each file on the disk, with the number of blocks in the file and the file type
- the total number of files on the disk

While the directory is being displayed or printed, hitting any key will suspend the operation until another key is hit. If the next key you hit is Q, the directory will be aborted and you can select another disk to display. Hitting the return key for both the ID and disk name will terminate the function and return you to the master function selection menu.

> *The handiest feature of Disk Master indicates on what disks a particular file can be found.*

4—Find specified file. This is probably the handiest feature of Disk Master, but it can be slow with the VIC 1541 disk when a large number of disks have been catalogued. This function provides a method of finding all copies of a particular file and indicates what disks they can be found on.

Again, you can use character-matching when entering the filename by adding a trailing asterisk, but at least one character must precede it. If an asterisk is not used, then the filename must match exactly to be displayed or printed. Otherwise, if the specified number of characters match, the file will be included in the list. For example, you can list all files that start with the word DISK by entering the filename DISK*.

Entering return alone for the filename will return the program to the master menu. While the list of files is being generated, hitting any key will suspend the operation until another key is pressed. If the next key you hit is Q, the operation will be terminated and you can enter another file to be sought.

5—List disk IDs and names. This function provides various lists of IDs and names for the disks currently catalogued. It displays another menu to select the desired list. While any list is being displayed or printed, hitting any key will suspend the operation until another key is pressed.

If you enter Q, the operation will be aborted, and control will return to the list-selection menu. Entering zero for the list selection will return you to the master function menu. The various lists provided are as follows.

Typing 1: prints a chart showing all disk IDs currently in use and catalogued. This is about a two-page list, and you must use a Commodore printer. It shows all IDs consisting of the numbers 0–9 and the letters A–Z in any combination.

It's intended to be used as a check sheet when you assign new IDs. This chart uses the PET graphics, so it'll probably not print correctly with non-Commodore printers.

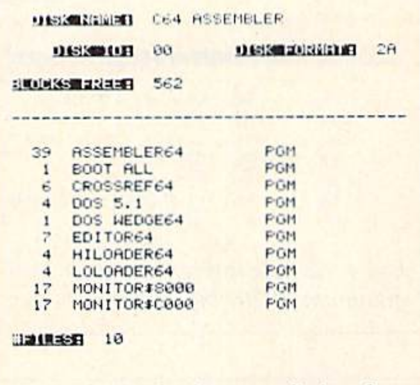
Typing 2: displays or prints in alphabetical order a quick list of all IDs currently in use. Only the IDs are given, along with an indication of the total number of IDs catalogued.

Typing 3: displays or prints a list of all IDs in use, along with the corresponding disk names. This list is printed in alphabetical order, as per the disk IDs.

Typing 4: displays or prints a list of all catalogued disks, showing the ID and name and the number of free blocks on each. The program allows you to specify the minimum number of free blocks a disk must have to be included in the list.

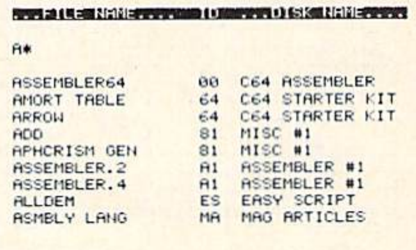
This lets you, for instance, indicate that you want a list of all disks with at least 100 free blocks. The default value is zero, so every disk currently catalogued will be listed if you don't change the value displayed.

Typing 5: similar to Typing 4, except that it asks you to specify a *maximum* number of free blocks for a particular disk to be included in the list. This allows you, for example, to call for a list



```
 DISK NAME:   C64 ASSEMBLER

   DISK ID:   00          DISK FORMAT:   2A

BLOCKS FREE:  562

------------------------------------------

  39   ASSEMBLER64           PGM
   1   BOOT ALL              PGM
   6   CROSSREF64            PGM
   4   DOS 5.1               PGM
   1   DOS WEDGE64           PGM
   7   EDITOR64              PGM
   4   HILOADER64            PGM
   4   LOLOADER64            PGM
  17   MONITOR$8000          PGM
  17   MONITOR$C000          PGM

#FILES:  10
```

Fig. 1. Sample directory listing for a specific disk.



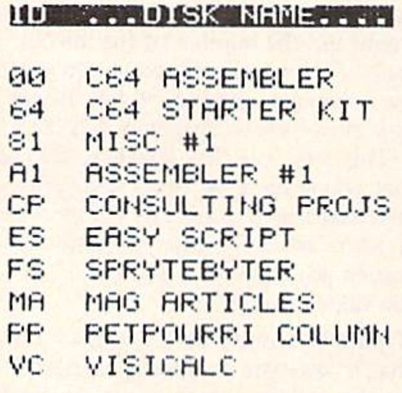
```
...FILE NAME.....   ID  ....DISK NAME....

A*

ASSEMBLER64         00  C64 ASSEMBLER
AMORT TABLE         64  C64 STARTER KIT
ARROW               64  C64 STARTER KIT
ADD                 81  MISC #1
APHCRISM GEN        81  MISC #1
ASSEMBLER.2         A1  ASSEMBLER #1
ASSEMBLER.4         A1  ASSEMBLER #1
ALLDEM              ES  EASY SCRIPT
ASMBLY LANG         MA  MAG ARTICLES
```

Fig. 2. Sample listing: finding all files starting with A.

of all disks with no more than 10 free blocks. An arbitrary default value has been preset at 99. If you enter a new number with a single-digit value, be sure to clear the last digit of the default 99 value.

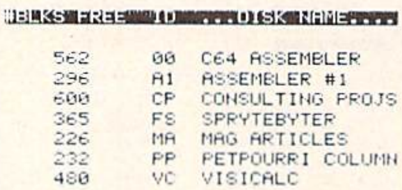
The Program

The key to Disk Master's operation is its ability to read any disk's directory blocks as a sequential data file. This is normally not documented in Commodore manuals, but it can easily be done as shown in line 440 of the program. Simply open a file by the name of $0 as a normal sequential file.



```
ID ...DISK NAME....

00  C64 ASSEMBLER
64  C64 STARTER KIT
81  MISC #1
A1  ASSEMBLER #1
CP  CONSULTING PROJS
ES  EASY SCRIPT
FS  SPRYTEBYTER
MA  MAG ARTICLES
PP  PETPOURRI COLUMN
VC  VISICALC
```

Fig. 3. Sample listing: disk IDs and names.



```
#BLKS FREE  ID  ...DISK NAME....

     562     00  C64 ASSEMBLER
     296     A1  ASSEMBLER #1
     600     CP  CONSULTING PROJS
     365     FS  SPRYTEBYTER
     226     MA  MAG ARTICLES
     232     PP  PETPOURRI COLUMN
     480     VC  VISICALC
```

Fig. 4. Sample listing: all disks with a minimum of 200 blocks free.

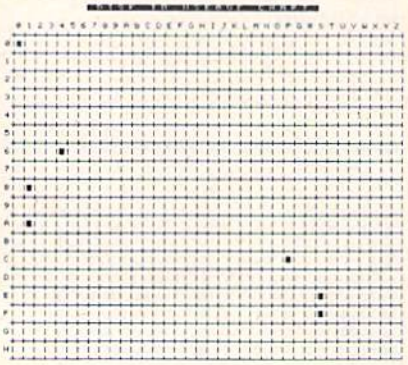


Fig. 5. Sample listing: partial ID usage chart.

This eliminates most compatibility problems, since the system will always handle the directory blocks in the same way, regardless of the C-64 or disk operating system ROMs. By using the disk command channel (channel 15) for all disk commands, the program is actually totally compatible with all current PET/CBM and C-64 systems with single disk drives.

When you delete a file, the only thing that happens is that the file-type flag is set to a value of 128 as shown in the chart. The information is actually still on the disk, but you normally can't get to it.

Looking at the program listing for Disk Master, lines 400–840 are used to read the directory information in the proper format and to check for previous entries in the master directory. Lines 850–970 then sort the directory entries and write a condensed directory on the master directory disk when it's reinserted.

This condensed directory contains the disk format and total number of free blocks, followed by the individual directory entries. Each file entry consists of a one-byte file type, the 16-character filename, and two bytes indicating the number of blocks in the file.

Thus, the original 30-byte directory entry is condensed to a 19-byte directory entry for each file on the disk. Most of the BAM and directory header information is stored in a cross-reference file that correlates the disk ID with the disk name.

Once the directory is opened as a file, the first character read identifies the type of disk and the disk format. A 1 indicates the older 2040 DOS 1.0 format disk, while a 65 indicates the newer DOS 2.x 4040, 2031 and VIC-1540/1541 formats. The remaining data in the directory header and block availability map (BAM) can then be read and properly decoded to find the disk name and ID, along with specific file information.

Some of the older Commodore user materials for the various disk drives include several tables that give the exact layout of the directory header, the block availability map (BAM) and the actual directory blocks. I've condensed some of the information here so you can see what Disk Master is reading.

Just remember that the program doesn't see the first two bytes of each disk block when it reads the directory as a sequential data file. The disk controller will automatically handle the linking from block to block for the program, so there's no need to worry about tracks and sectors.

As you can see in Table 1, the disk header block is identical for the 2040/4040, 2031 and VIC-1540/1541 disks. In all cases it is stored on track 18, sector 0 of the disk. It indicates the location of the first directory block, the DOS format, the disk name and ID, plus the BAM.

The BAM indicates which blocks are used and which are available, using a map with one bit for each block on the disk. If the bit is set (1), the block is

Byte	Contents	Definition
0–1	18,1	Track & sector of first directory block
2	1	DOS 1 format on 2040/4040
	65	ASCII "A" for 4040 format and VIC-1540/1541
3	0	null flag
4–143	. . . .	BAM—bit map of available blocks for tracks 1–35 (4 bytes per track) byte 0 = #available sectors in track byte 1 = bit map for sectors 0–7 byte 2 = bit map for sectors 8–15 byte 3 = bit map for sectors 16–23 in bit maps, 1 = available 0 = unavailable (used)
144–161	. . . .	disk name padded with shifted spaces
162–163	. . . .	disk ID
164	160	shifted space
165–166	160,160	shifted spaces on 2040 DOS 1
	50,65	ASCII "2A" for 4040 DOS version
167–170	160's	shifted spaces
171–255	0	nulls, unused

Table 1. Disk Header Block—Track 18, Sector 0. Block availability map for VIC-1540/1541 and 2040/4040 disks.

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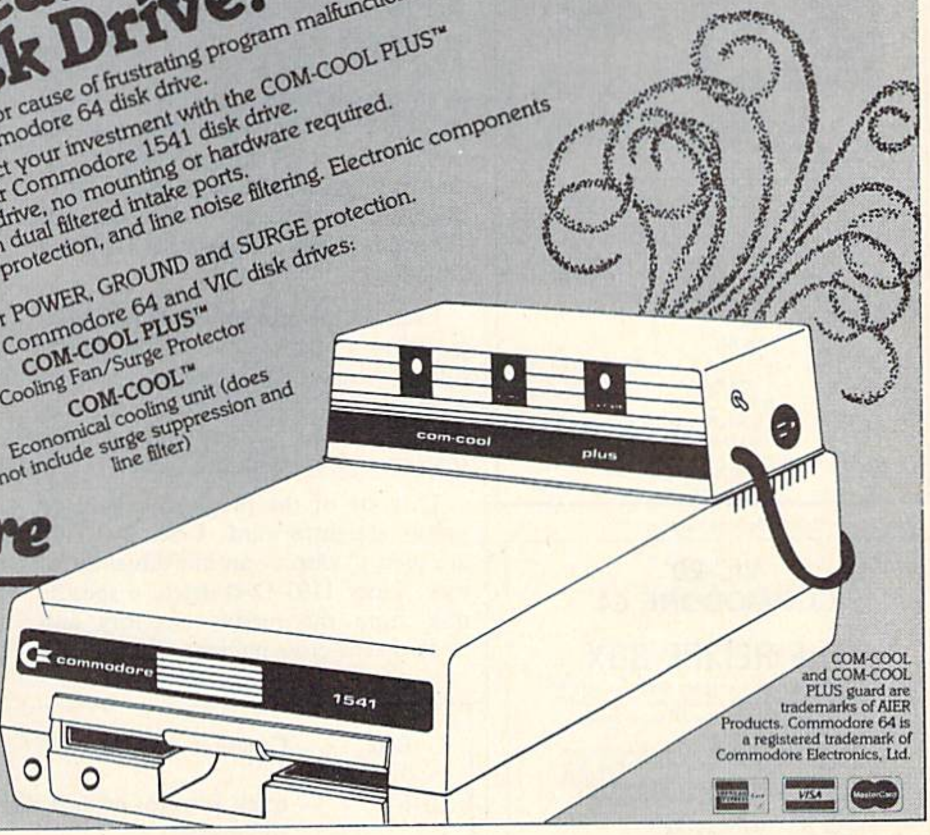

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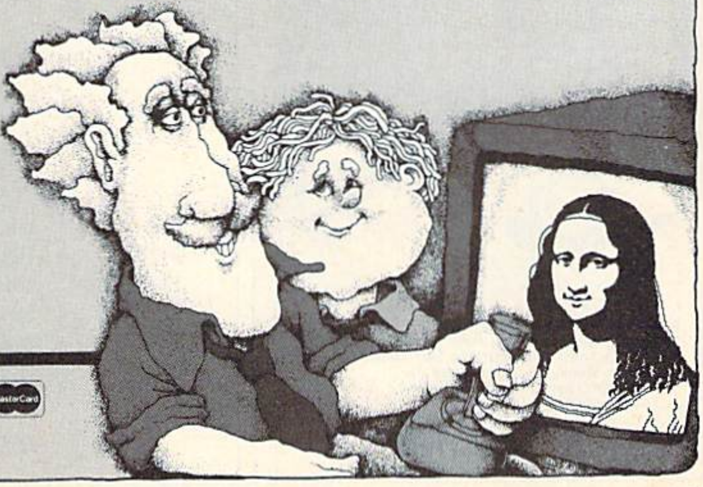

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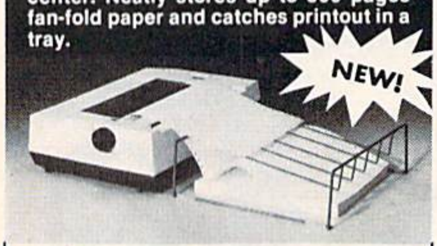

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available; it is unavailable when the bit is cleared (0).

Each directory block then contains a link to the next directory block, plus specific information for eight files. The entry for each file is identical in format, as shown in Table 3. It contains a flag specifying the file type, a pointer to the first block of the file, the filename padded with spaces, the file size and additional information for relative files and file replacement, using the OPEN@ function.

Each of the condensed directories is stored as a separate file on the master directory disk. This means you can catalog about 140 entries with the VIC-1541 drive. This should be more than enough for almost anyone.

The rest of the program should be pretty straightforward. Lines 980–1170 are used to display an individual directory. Lines 1180–1240 delete a specific disk from the master directory and clean up the cross reference list.

Lines 1250–1680 and 2450–2610 perform the various listing functions. Lines 1690–1860 are used to find what disk contains a specific file or group of files. Lines 220–280 and 1870–2440 are various subroutines used by the rest of the program.

The graphics characters used to make the disk ID chart in lines 1430 and 1440 are the shifted plus sign and asterisk on the C-64. The last character is entered by holding down the Commodore key and pressing W.

The graphics characters in lines 1530 and 1540 are the combined Commodore and E keys, plus the shifted asterisk. The last character is the combined Commodore and X keys. Lines 1040 and 2150 contain 39 dashes or shifted asterisks (your choice).

If you should have any difficulty entering the program or would just rather avoid all the typing, I'll be happy to supply a copy on a VIC-1541 format disk if you'll send me $10 to cover costs. R

Byte	Contents
0–1	track & sector of next directory block, track = 0 in last directory block
2–31	file entry #1
34–63	file entry #2
66–95	file entry #3
98–127	file entry #4
130–159	file entry #5
162–191	file entry #6
194–223	file entry #7
226–255	file entry #8

Table 2. Common Directory Block. First directory block on Track 18, Sector 1—for Vic-1540/1541 and 2040/4040 disks.

Byte	Contents
0	File type flag: 128 = file deleted 129 = Sequential file 130 = Program file 131 = User file 132 = Relative file
1–2	track & sector of first block in file
3–18	file name padded with shifted spaces
19–20	track & sector of first side sector block for relative file only
21	binary record size for relative files
22–25	unused
26–27	track & sector of replacement file for OPEN@
28–29	number of blocks in file (low byte, high byte)

Table 3. Structure of single directory entries.

Listing of the Disk Master program for the C-64.

```
10 REM --------- DISK MASTER --------
20 REM
30 REM      SINGLE VIC-1541 DISK
40 REM     ON COMMODORE-64 SYSTEM
50 REM
60 REM          ROBERT W. BAKER
70 REM  15 WINDSOR DR, ATCO, NJ 08004
80 REM
90 REM ----------------------------
100 :
110 CLR:C$="":S$=C$:X=0:Y=0
120 CR$=CHR$(13):HC$=CHR$(147):RV$=CHR$(18):RF$=CHR$(14
   6):CL$=CHR$(157)
130 REM CR = CARRIAGE RETURN,  HC = HOME/CLEAR,  RV = R
   EVERSE ON
140 REM RF = REVERSE OFF,       CL = CURSER LEFT
150 GOSUB 2140:DIM D$(230),X$(230)
160 PRINT"   READING DIRECTORY CROSS REFERENCE"
170 OPEN15,8,15,"I0":GOSUB 2220
180 OPEN 5,8,5,"0:DISK DIR XREF,S,R"
190 INPUT#15,EN,EM$,ET,ES:IFEN=62THEN 290
200 INPUT#5,X$(NX):SS=ST:GOSUB 2220:NX=NX+1:IF SS=0 THE
   N 200
210 GOTO 290
220 S$="":FOR X=1 TO Y:GOSUB 260:S$=S$+C$:NEXT X:RETURN

230 FOR X=1 TO Y:GOSUB 260:NEXT X:RETURN
240 V=0:GOSUB 260:IF C$<>"" THEN V=ASC(C$)
250 RETURN
260 GET#5,C$
270 SS=ST:INPUT#15,EN,EM$,ET,ES:IF EN=0 THEN RETURN
280 PRINT HC$;RV$;"DISK ERROR!":PRINT:GOTO 2270
290 CLOSE 4:CLOSE 5:CX=0:GOSUB 2140
300 PRINT SPC(5);"0 - DONE":PRINT
310 PRINT SPC(5);"1 - UPDATE MASTER DIRECTORY":PRINT
320 PRINT SPC(5);"2 - DELETE DISK ENTRY FROM MASTER":PR
   INT
330 PRINT SPC(5);"3 - DISPLAY SELECTED DIRECTORY":PRINT

340 PRINT SPC(5);"4 - FIND SPECIFIED FILE":PRINT
350 PRINT SPC(5);"5 - LIST DISK ID'S & NAMES"
360 GOSUB 2150:PRINT"ENTER DESIRED FUNCTION:  ";
370 GOSUB 2120:IF C$="0" THEN PRINT HC$:GOTO 2380
380 V=VAL(C$):IF V<1 OR V>5 THEN 370
390 ON V GOTO 400,1180,980,1690,1250
400 CLOSE 15:CX=0:PRINT HC$;"INSERT DISK TO BE CATALOGE
   D"
410 PRINT:PRINT"DEPRESS ANY KEY TO CONTINUE, ";RV$;"Q";
   RF$;" TO QUIT"
```

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```
420 GOSUB 2120:IF C$="Q" THEN GOSUB 2390:GOTO 290
430 GOSUB 2150:PRINT"OK":OPEN15,8,15,"IO":GOSUB 270
440 OPEN5,8,5,"$0,S,R":GOSUB270
450 GOSUB 240:VF=V:GOSUB 260
460 NB=0:FOR Z=1 TO 35:GOSUB 240:IF Z<>18 THEN NB=NB+V
470 Y=3:GOSUB 230:NEXT Z
480 Y=16:GOSUB 220:DN$=S$:Y=2:GOSUB 230
490 Y=2:GOSUB 220:DI$=LEFT$(S$+"  ",2)
500 GOSUB 2160:IF C$="N" THEN 970
510 IF NX=0 THEN 630
520 FOR X=0 TO NX-1:C$=LEFT$(X$(X),2):IF DI$<C$ THEN 63
     0
530 IF DI$<>C$ THEN NEXT X:GOTO 630
540 IF DN$=MID$(X$(X),3) THEN 630
550 PRINT HC$;RV$;"*** WARNING ***";RF$;"  THIS DISK ID
     : ";RV$;DI$;RF$
560 PRINT:PRINT"DISK NAME: ";RV$;DN$
570 PRINT:PRINT"IS ALL READY CATALOGED WITH A DIFFERENT
     "
580 PRINT:PRINT"DISK NAME: ";RV$;MID$(X$(X),3):GOSUB 21
     50
590 PRINT"CATALOGING THIS DISK WILL DELETE THE"
600 PRINT:PRINT"PREVIOUS DATA!":GOSUB 2150
610 PRINT"CATALOG THIS DISK";:GOSUB 2190:IF C$="N" THEN
     970
620 PRINT HC$;"CATALOGING DISK WITH NEW DISK NAME"
630 GOSUB 2150:PRINT"READING DIRECTORY ENTRIES ..."
640 GOSUB 260:Y=2:GOSUB 220:DF$=S$:Y=89
650 IF VF=1 THEN DF$=" 1"
660 GOSUB 230
670 NF=0:Z=0
680 GOSUB 240:FT=V
690 F$=C$:Y=2:GOSUB 230:Y=16:GOSUB 220:Y=9:GOSUB 230
700 GOSUB 240:S$=S$+CHR$(V):GOSUB 240:IF FT=0 THEN 770
710 IF NF=0 THEN 740
720 FOR X=1 TO NF:IF LEFT$(S$,16) < MID$(D$(X),2,16) TH
     EN 750
730 NEXT X
740 X=NF+1:GOTO 760
750 FOR Y=NF TO X STEP-1:D$(Y+1)=D$(Y):NEXT Y
760 D$(X)=F$+S$+CHR$(V):NF=NF+1
770 Z=Z+1:Z=Z-(INT(Z/8)*8):IF Z>0 THEN Y=2:GOSUB 230
780 IF NF<155THEN 840
790 PRINT HC$;SPC(6);RV$;"*** DISK BAM IS INVALID ***";
     RF$:GOSUB 2150
800 PRINT:PRINT"   CURRENT DISK CANNOT BE CATALOGED!":P
     RINT:PRINT:PRINT
810 PRINT" PLEASE VERIFY OR CHECK DISK CONTENTS":PRINT
820 PRINT"BEFORE ATTEMPTING TO CATALOG THIS DISK.":PRIN
     T
830 GOSUB 2150:GOSUB 2110:GOTO 970
840 IF SS=0 THEN 680
850 CLOSE 5:GOSUB 2390:GOSUB 2150:PRINT"UPDATING MASTER
      DIRECTORY ..."
860 IF NX=0 THEN 910
870 FOR X=0 TO NX-1:C$=LEFT$(X$(X),2):IF DI$ < C$ THEN
      900
880 IF DI$=C$ THEN 930
890 NEXT X:GOTO 910
900 FOR Y=NX-1 TO X STEP-1:X$(Y+1)=X$(Y):NEXT Y:GOTO 92
      0
910 X=NX
920 NX=NX+1
930 X$(X)=DI$+DN$:CX=1
940 GOSUB 2030:PRINT#15,"S"+S$:OPEN 5,8,5,S$+",S,W":GOS
      UB 270
950 PRINT#5,DF$;",";NB;CR$;:GOSUB 270
960 IF NF>0 THEN FOR X=1 TO NF:PRINT#5,D$(X);CR$;:GOSUB
      270:NEXT X
970 CLOSE 5:GOSUB 2290:GOTO 400
980 PRINT HC$;"TO DISPLAY DISK DIRECTORY":GOSUB 1870:ON
      V GOTO 290,980
990 OPEN 5,8,5,S$+",S,R":GOSUB 270:GOSUB 2070:INPUT#5,D
      F$,NB:GOSUB 270
1000 PRINT#4,"  ";RV$;"DISK NAME:";RF$;"  ";DN$:PRINT#4

1010 PRINT#4,""SPC(4);RV$;"DISK ID:";RF$;"  ";DI$;SPC(6
      )
1020 PRINT#4,RV$;"DISK FORMAT:";RF$;"  "DF$:PRINT#4
1030 PRINT#4,RV$;"BLOCKS FREE:";RF$;" ";NB:PRINT#4
1040 PRINT#4,"---------------------------------------":
      PRINT#4
1050 NF=0:IF SS>0 THEN 1160
1060 GOSUB 240:FT=V:Y=16:GOSUB 220:GOSUB 240:Z=V:GOSUB
      240:GOSUB 260
1070 PRINT#4,RIGHT$("    "+STR$(Z+(256*V)),4);"  ";S$;"
        ";
1080 IF FT=129 THEN PRINT#4,"SEQ";
1090 IF FT=130 THEN PRINT#4,"PGM";
1100 IF FT=131 THEN PRINT#4,"USR";
1110 IF FT=132 THEN PRINT#4,"REL";

1120 PRINT#4:GET C$:IF C$<>"" THEN GOSUB 2120
1130 IF C$="Q" THEN 1170
1140 NF=NF+1:IF SS=0 THEN 1060
1150 PRINT#4:PRINT#4,RV$;"#FILES:";RF$;" ";NF
1160 IF PD=3 THEN GOSUB 2150:GOSUB 2110
1170 CLOSE 4:CLOSE 5:GOTO 980
1180 PRINT HC$;"TO DELETE DISK FROM MASTER DIRECTORY"
1190 GOSUB 1870:ON V GOTO 1240,1180
```

More

Listing continued

```
1200 PRINT#15,"S"+S$
1210 CX=0:FOR X=0 TO NX-1:IF LEFT$(X$(X),2)=DI$ THEN CX
     =1
1220 IF CX THEN X$(X)=X$(X+1)
1230 NEXT X:NX=NX-1:GOTO 1180
1240 GOSUB 2290:GOTO 290
1250 IF NX=0 THEN GOSUB 1880:GOTO 290
1260 CLOSE 4:GOSUB 2140
1270 PRINT SPC(5);"0 - RETURN TO MAIN FUNCTION MENU":PR
     INT
1280 PRINT SPC(5);"1 - PRINT FULL ID USEAGE CHART":PRIN
     T
1290 PRINT SPC(5);"2 - QUICK LIST OF ID'S IN USE":PRINT

1300 PRINT SPC(5);"3 - LIST DISK ID'S & NAMES":PRINT
1310 PRINT SPC(5);"4 - LIST ";RV$;"MIN";RF$;" FREE BLOC
     KS PER DISK":PRINT
1320 PRINT SPC(5);"5 - LIST ";RV$;"MAX";RF$;" FREE BLOC
     KS PER DISK"
1330 GOSUB 2150:PRINT"ENTER DESIRED FUNCTION:  ";
1340 GOSUB 2120:IF C$="0" THEN 290
1350 V=VAL(C$):IF V<1 OR V>5 THEN 1340
1360 PRINT C$:ON V GOTO 1370,1550,1620,2450,2490
1370 OPEN 4,4
1380 PRINT#4,""SPC(15);RV$;"  D I S K   I D   U S E A G
     E   C H A R T  "
1390 PRINT#4: PRINT#4," ";
1400 FOR X=48 TO 90:IF X=58 THEN X=65
1410 PRINT#4," ";CHR$(X);:NEXT X:PRINT#4
1420 Z=0:FOR X=48 TO 90:IF X=58 THEN X=65
1430 PRINT#4," [SHFT +][SHFT *][SHFT +][SHFT *][SHFT +]
     [SHFT *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][S
     HFT *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHF
     T *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHFT
     [SHFT *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][S
     HFT *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHF
     T *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHFT
     *][SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHFT *]
     [SHFT *][SHFT +]";
1440 PRINT#4,"[SHFT *][SHFT +][SHFT *][SHFT +][SHFT *][
     SHFT +][SHFT *][SHFT +][SHFT *][SHFT +][SHFT *][CO
     MD W]"
1450 PRINT#4,CHR$(X);
1460 FOR Y=48 TO 90:IF Y=58 THEN Y=65
1470 PRINT#4,CHR$(221);:IF Z=NX THEN 1500
1480 C$=CHR$(X)+CHR$(Y):S$=LEFT$(X$(Z),2)
1490 IF S$=C$ THEN PRINT#4,CHR$(166);:Z=Z+1:GOTO 1510
1500 PRINT#4," ";
1510 NEXT Y:PRINT#4,CHR$(221):GET C$:IF C$<>"" THEN GOS
     UB 2120
1520 IF C$<>"Q" THEN NEXT X
1530 PRINT#4," [COMD E][SHFT *][COMD E][SHFT *][COMD E]
     [SHFT *][COMD E][SHFT *][COMD E][SHFT *][COMD E][S
     HFT *][COMD E][SHFT *][COMD E][SHFT *][COMD E][SHF
     T *][COMD E][SHFT *][COMD E][SHFT *][COMD E][SHFT
     [SHFT *][COMD E][SHFT *][COMD E][SHFT *][COMD E][S
     HFT *][COMD E][SHFT *][COMD E][SHFT *][COMD E][SHF
     T *][COMD E][SHFT *][COMD E][SHFT *][COMD E][SHFT
     *][COMD E][SHFT *][COMD E][SHFT *][COMD E][SHFT *]
     [SHFT *][COMD E]";
1540 PRINT#4,"[SHFT *][COMD E][SHFT *][COMD E][SHFT *][
     COMD E][SHFT *][COMD E][SHFT *][COMD E][SHFT *][CO
     MD X]":GOTO 1260
1550 GOSUB 2070:PRINT#4,""SPC(7);"[CTRL 9]DISK ID'S CUR
     RENTLY IN USE"
1560 PRINT#4:PRINT#4
1570 V=12:IF PD=4 THEN V=25
1580 Z=0:FOR X=0 TO NX-1:PRINT#4,LEFT$(X$(X),2);" ";
1590 Z=Z+1:IF Z=INT(Z/V)*V THEN PRINT#4
1600 NEXT X:PRINT#4:PRINT#4:IF Z<>INT(Z/V)*V THEN PRINT
     #4
1610 PRINT#4,Z;RV$;"DISKS IN MASTER DIRECTORY":GOTO 167
     0
1620 GOSUB 2070:PRINT#4,RV$;"ID  ...DISK NAME....":PRIN
     T#4
1630 FOR X=0 TO NX-1:PRINT#4,LEFT$(X$(X),2);"  ";MID$(X
     $(X),3)
1640 GET C$:IF C$<>"" THEN GOSUB 2120
1650 IF C$="Q" THEN 1260
1660 NEXT X
1670 IF PD=4 THEN 1260
1680 GOSUB 2150:GOSUB 2110:GOTO 1260
1690 IF NX=0 THEN GOSUB 1880:GOTO 290
1700 CLOSE 4:PRINT HC$;"TO FIND WHAT DISK(S) A FILE IS
     ON":PRINT
1710 PRINT"ENTER FILE NAME   .";CL$;CL$;CL$;:INPUT F$:
     IF F$="." THEN 290
1720 IF F$="*" THEN PRINT:PRINT"RE-";:GOTO 1710
1730 S$=F$:GOSUB 2040:V=Y:GOSUB 2070
1740 PRINT#4,RV$;"...FILE NAME....  ID  ...DISK NAME...
     .":PRINT#4
1750 PRINT#4,S$:PRINT#4
1760 FOR Z=0 TO NX-1:DI$=LEFT$(X$(Z),2):DN$=MID$(X$(Z),
     3)
1770 GOSUB 2030:OPEN 5,8,5,S$+",S,R":EF=15:GOSUB 270:IN
     PUT#5,DF$,NB:GOSUB 270
1780 GOSUB 260:Y=16:GOSUB 220:Y=3:GOSUB 230
1790 IF F$ < LEFT$(S$,V) THEN 1840
1800 IF F$ = LEFT$(S$,V) THEN PRINT#4,S$;"  ";DI$;"  ";
     DN$: REM <- 2 SPACES EA
```

More

Listing continued

```
1810 GET C$:IF C$<>"" THEN GOSUB 2120
1820 IF C$="Q" THEN CLOSE 5:GOTO 1700
1830 IF SS=0 THEN 1780
1840 CLOSE 5:NEXT Z
1850 IF PD=3 THEN GOSUB 2150:GOSUB 2110
1860 GOTO 1700
1870 V=3:IF NX>0 THEN 1890
1880 PRINT HC$;RV$;"NO ENTRIES";:V=1:GOTO 2010
1890 PRINT:PRINT "ENTER DISK ID   .";CL$;CL$;CL$;:INPUT
      DI$
1900 DI$=LEFT$(DI$+"  ",2):IF DI$=". " THEN 1950
1910 FOR X=0 TO NX-1:IF DI$<>LEFT$(X$(X),2) THEN NEXT X
      :GOTO 2000
1920 DN$=MID$(X$(X),3):DI$=LEFT$(X$(X),2)
1930 GOSUB 2160:IF C$="N" THEN V=2:RETURN
1940 GOTO 2030
1950 PRINT:PRINT"ENTER DISK NAME    .";CL$;CL$;CL$;:INPU
      T F$
1960 IF F$="." THEN V=1: RETURN
1970 GOSUB 2040:FOR X=0 TO NX-1:IF Y=0 THEN 2020
1980 IF F$=MID$(X$(X),3,Y) THEN 2020
1990 NEXT X
2000 PRINT:PRINT RV$;"NOT";:V=2
2010 PRINT" IN MASTER DIRECTORY!":GOSUB 2150:GOTO 2110
2020 DN$=MID$(X$(X),3):DI$=LEFT$(X$(X),2):GOSUB 2160:IF
      C$="N" THEN 1990
2030 S$="0:DIR."+DI$:RETURN
2040 F$=LEFT$(F$,16)
2050 IF RIGHT$(F$,1)="*" THEN Y=LEN(F$)-1:F$=LEFT$(F$,Y
      ):RETURN
2060 Y=16:F$=LEFT$(F$+"[16 SPACES]",16):RETURN
2070 GOSUB 2150:PRINT"WANT PRINTED COPY";:GOSUB 2190:GO
      SUB 2150
2080 PD=3:IF C$="Y" THEN PD=4
2090 OPEN 4,PD:IF PD=3 THEN PRINT HC$;
2100 RETURN
2110 PRINT"DEPRESS ANY KEY TO CONTINUE"
2120 GET C$:IF C$="" THEN 2120
2130 RETURN
2140 PRINT HC$;SPC(9);RV$;"D I S K   M A S T E R"
2150 PRINT:PRINT"--------------------------------------
      --":RETURN
2160 PRINT HC$;RV$;"DISK NAME:";RF$;"  ";DN$:PRINT
2170 PRINT "  ";RV$;"DISK ID:";RF$;"  ";DI$:GOSUB 2150
2180 PRINT"CORRECT DISK";
2190 PRINT" (Y/N) ?  ";
2200 GOSUB 2120:IF C$<>"Y" AND C$<>"N" THEN 2200
2210 PRINT C$:RETURN
2220 INPUT#15,EN,EM$,ET,ES:IF EN=0 THEN RETURN
2230 PRINT HC$;RV$;"DISK ERROR";RF$;" WHILE ";
2240 IF CX THEN PRINT"WRITING NEW"
2250 IF CX=0 THEN PRINT"READING"
2260 PRINT:PRINT"DISK DIRECTORY CROSS REFERENCE FILE.":
      PRINT
2270 PRINT EN;EM$;ET;ES
2280 PRINT:PRINT RV$;"PROGRAM ABORTED!":GOTO 2380
2290 IF CX=0 THEN RETURN
2300 GOSUB 2150:PRINT"UPDATING DIRECTORY CROSS REFERENC
      E ...":PRINT
2310 IF NX=0 THEN PRINT#15,"S0:DISK DIR XREF":RETURN
2320 PRINT#15,"S0:DIR XREF.TEMP"
2330 OPEN 5,8,5,"0:DIR XREF.TEMP,S,W":GOSUB 2220
2340 FOR X=0 TO NX-1:PRINT#5,X$(X);CR$;:GOSUB 2220:NEXT
      X
2350 CLOSE 5:PRINT#15,"S0:DISK DIR XREF"
2360 PRINT#15,"R0:DISK DIR XREF=0:DIR XREF.TEMP":GOSUB
      2220
2370 RETURN
2380 CLOSE 4:CLOSE 5:CLOSE 15:END
2390 PRINT HC$;
2400 CLOSE 15:PRINT"INSERT MASTER DISK":PRINT:GOSUB 211
      0
2410 OPEN 15,8,15,"I0":GOSUB 270
2420 PRINT#15,"C0:DISK MASTER=0:DISK MASTER"
2430 INPUT#15,EN: IF EN=63 THEN RETURN
2440 PRINT:PRINT RV$;"INCORRECT DISK!":GOSUB 2150:GOTO
      2400
2450 PRINT HC$;"ENTER MINIMUM NUMBER OF FREE BLOCKS"
2460 PRINT:PRINT"TO BE DISPLAYED   0";CL$;CL$;CL$;:INPU
      T S$: REM - DEFAULT=0
2470 Y=VAL(S$):IF S$<>"0" AND Y=0 THEN 1260
2480 VF=0:GOTO 2530
2490 PRINT HC$;"ENTER MAXIMUM NUMBER OF FREE BLOCKS"
2500 PRINT:PRINT"TO BE DISPLAYED   99";CL$;CL$;CL$;CL$;
      :INPUT S$
2510 Y=VAL(S$):IF Y=0 THEN 1260
2520 VF=1
2530 GOSUB 2070:PRINT#4,RV$;"#BLKS FREE  ID  ...DISK NA
      ME....":PRINT#4
2540 FOR X=0 TO NX-1:DI$=LEFT$(X$(X),2):DN$=MID$(X$(X),
      3)
2550 OPEN 5,8,5,"0:DIR."+DI$+",S,R":GOSUB 270:INPUT#5,D
      F$,NB:GOSUB 270:CLOSE 5
2560 IF (VF=0) AND (NB<Y) THEN 2590
2570 IF (VF=1) AND (NB>Y) THEN 2590
2580 PRINT#4,RIGHT$("[7 SPACES]"+STR$(NB),7);SPC(5);DI$
      ;"  ";DN$
2590 GET C$:IF C$<>"" THEN GOSUB 2120
2600 IF C$="Q" THEN 1260
2610 NEXT X:GOTO 1670
```

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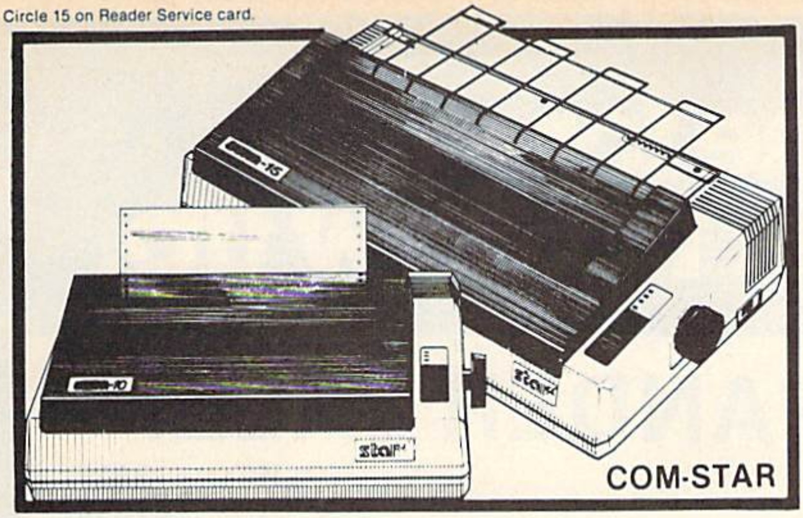

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The Straight A Program

With this program, you can be an absent-minded professor and still keep track of your students' statistics. You can also modify this Class Roster program to handle other applications involving numerical data.

By Norman Levitt

RUN It Right

C-64; disk drive
Printer optional

Address author correspondence to Norman Levitt, Dept. of Mathematics, Rutgers University, New Brunswick, NJ 08903.

I find that the most onerous part of my job as a university teacher is keeping track of students' progress (or lack thereof) in a given course. The most tiresome aspect—reading and grading exams, quizzes, homework and the like—is also the most thoroughly resistant to computer assistance (unless you use multiple-choice, machine-graded tests).

The biggest, fastest mainframe in existence can't read or grade a term paper on Shelly's "Ozymandias," a final-exam essay on the Medici banking system or a calculus problem set. Nonetheless, the most mechanical aspects of course record keeping can be greatly facilitated by the right sort of program.

The Class Roster program not only enters, stores, and collates class records, but also assigns final letter grades on the basis of various inputs—exams, homework, etc.—fed into a formula that will make the results "fair" by whatever standards you choose to apply. The program lets you not only devise, but also modify this formula at will.

Exam Time

In addition to the raw data of test and homework scores, the program also takes into account "weights" for the various raw scores; that is, factors by which you can multiply these scores to adjust for their relative importance. For instance, you may decide that the second midterm exam should count twice as heavily as the first, the final 1½ times as much as the second midterm and the cumulative homework only half as much as the first midterm. The program obtains values for these weights as inputs and stores them along with the individual record data. You can adjust or revise these weights at any time.

The program also provides for numerical cutoff points in assigning letter grades. Whatever formula you use calculates a cumulative score for each individual and then assigns letter grades on the basis of the cutoff information (lowest A, lowest B+, etc.) that you've provided. Cutoffs are also stored with records and weights, and can be revised just as easily.

This program is designed to accommodate up to 200 individual records. A roster option lets you display or print out a complete list of students, together with their cumulative scores to date and their letter grades, if the latter are desired. You can retrieve individual records with all data included by a "search" option—again, either in hard copy or on the screen.

You can also extract summaries of data for the class as a whole. Summary options include statistics (median cumulative score and mean and standard deviation), grade distribution (a bar graph showing the number of students awarded each grade) and grade separation (high and low cumulative scores within each letter grade category).

The program runs on a Commodore 64 with a 1541 disk drive or equivalent, and uses any compatible printer interface for hard-copy output. A printer isn't necessary, however, since all printout routines are optional. Some of the screen displays are multi-colored, but a black-and-white monitor works perfectly well.

The heart of this program is adapted from Commodore's own Random File mail list example, found on the demo disk that comes with the 1541. The basic Read from Disk and Write to Disk subroutines and the index file system are pretty much the same. However, the specialized option subroutines included here make this program much more complex, requiring upwards of 20K of RAM available to Basic.

Starting Your Homework

This program requires a formatted disk for storage of records and a different disk for each class. After loading and running the program, you hit the I key to get started. When you're told to insert a record disk into the drive, replace the program disk with the disk being used for your files. Then hit S to continue operations.

After asking you if you want letter-grade computation done (presumably premature at the beginning of a term), the program asks whether the record disk is being used for the first time for this particular class. (You can use a disk with old records on it as a new disk, since the program will never "see" the old records; scratching is not necessary.)

If this is a first-time use, the program asks you to double-check (to avoid inadvertantly dumping active files) and then asks you to input weights for the exams and homework. Since the program, as written, handles three midterm exams, one final and a total homework figure, you will need five such weights. These can have any numerical value you choose, but it's advisable to select values so that the theoretical maximum cumulative score for any student is less than 2000. (If you plan fewer than three midterms or don't take homework into account, then the weights for the unused items are irrelevant.)

When you've assigned the weights, you'll be asked for grade cutoffs, providing you've chosen the letter grade assignment option. Cutoff for a given grade means the lowest cumulative score which can earn that grade. As the program is written, the possible letter grades are F, D, C, C+, B, B+ and A—chosen simply because these are the official grades at Rutgers, where I teach.

If you're updating established records, the flow is similar. You're asked if you want to change the weights and cutoffs previously entered. After you've updated the weights and cutoffs—or declined to do so—you go to the roster routine.

The inquiry ROSTER? on the screen asks you whether you want the class roster displayed. If you decline (by hitting N), you go to the main job menu. Y gives you the further choice of a scrolling screen display or a hard-copy printout of the entire roster, after which you hit R to go to the main job menu.

If you decline a printout, you start the screen display by hitting D; W will freeze the existing display on the screen. After freezing, or after a display of the entire roster, you hit R to go to the main job menu. The format for the roster display is a single line with file number, cumulative score to date, letter grade (if that option was originally elected), last name and first name.

Listing 1. Class Roster program.

```
1 REM    ****************************
2 REM    *                          *
3 REM    *   CLASS ROSTER AND       *
4 REM    *      RECORDS             *
5 REM    *                          *
6 REM    *                          *
7 REM    *                          *   LISTING
8 REM    *                          *   CONVENTIONS
9 REM    *                          *   AT 7000
10 REM   *                          *
11 REM   ****************************
12 POKE53281,1:PRINT"[SHFT CLR]":PRINT"[CTRL 1]"
13 PRINT"[CRSR DN][CRSR DN]  CLASS ROSTER AND RECORDS":
     PRINT"  (WITH GRADE ASSIGNMENT OPTION)"
14 PRINT:PRINT:PRINT:PRINT:PRINT"HIT I TO BEGIN"
15 GETX$:IFX$<>"I" THEN 15
19 DIMU(200):DIMI$(200):DIMHZ(2000):FD=0:FX=5:CH=2:FP=1
     :PRINT"[SHFT CLR][CRSR DN][CRSR DN]"
20 PRINT"  INSERT DISC WITH CLASS RECORDS":PRINT:PRINT:
     PRINT:PRINT:PRINT:PRINT
22 PRINT"[21 SHFT DS]"
24 PRINT"  DONE?  TO CONTINUE HIT S"
25 GETP$:IFP$<>"S"THEN25
26 PRINT"[SHFT CLR]":PRINT"[CRSR DN][CRSR DN][CRSR DN][
     CRSR DN]":INPUT"LETTER GRADE ASSIGNMENT DESIRED";G
     RD$
29 OPEN15,8,15,"IO":OPEN2,8,2,"#"
30 PRINT"[SHFT CLR][CRSR DN][22 SHFT FS]"
32 PRINT"INDEX FILE OPERATION"
34 PRINT"[22 SHFT DS]"
36 INPUT"[CRSR DN]      NEW SHEET? N[CRSR LF][CRSR LF][C
     RSR LF]";O$:PRINT""
37 IFO$="N"THEN2000
38 IFO$<>"Y"THEN36
39 INPUT"ARE YOU SURE";O$
40 IFO$<>"Y"THENPRINT"[SHFT CLR]":GOTO36
43 GOTO2200
45 GOTO50
46 OPEN5,8,5,"0:INDEX,S,R"
47 FORI=1TO200:INPUT#5,I$(I)
49 NEXTI:CLOSE5
50 GOSUB1300
51 PRINT"[SHFT CLR]"
52 PRINT"     JOB MENU          "
54 PRINT"[22 SHFT DS]"
56 PRINT
58 PRINT"     1=CREATE/UPDATE"
60 PRINT"     2=DELETE"
62 PRINT"     3=SEARCH"
63 PRINT"     4=SUMMARY"
64 PRINT"     0=END"
65 PRINT
66 INPUT"1 , 2 , 3 , 4 , 0   1[CRSR LF][CRSR LF][CRSR L
     F]";O$
68 IFO$="0"THEN2500
70 IFO$="1"THEN104
71 IF O$="4"THENGOTO3000
72 IFO$="3"THEN300
74 IFO$<>"2"THEN50
76 GOTO200
100 REM ************************
102 REM * MASTER FILE CREATE  *
103 REM ************************
104 PRINT"[SHFT CLR][CRSR DN][CRSR DN][29 SHFT FS]"
105 PRINT" [SHFT SPACE]MASTER FILE CREATE/UPDATE"
106 PRINT"[29 SHFT DS]"
107 INPUT"RECORD NO. = 0[CRSR LF][CRSR LF][CRSR LF]";F
108 IF F=0THEN170
109 IF F>200 THEN107
110 GOSUB1500
160 GOTO104
```

More

Listing 1 continued.

```
170 OPEN5,8,5,"@0:INDEX,S,W"
175 FORI=1TO200:PRINT#5,I$(I);CHR$(13);
185 NEXT:CLOSE5
190 GOTO74
200 REM ************************
201 REM *  MASTER FILE DELETE *
202 REM ************************
210 PRINT"[SHFT CLR][CRSR DN][CRSR DN][22 SHFT FS]"
212 PRINT"  MASTER FILE DELETE"
214 PRINT"[22 SHFT DS]":PRINT
220 INPUT"RECORD NO. = 0[CRSR LF][CRSR LF][CRSR LF]";F
230 IFF=0THEN260
233 IF F>200THEN220
235 IFI$(F)<>"1"THEN220
240 I$(F)="/":PRINT"[CRSR DN]RECORD NO."F;"DELETE"
250 GOTO220
260 OPEN5,8,5,"@0:INDEX,S,W"
265 FORI=1TO200:PRINT#5,I$(I);CHR$(13);
275 NEXT:CLOSE5
280 GOTO50
300 REM    ************************
301 REM    *  FILE SEARCH/DISPLAY *
302 REM    ************************
303 PRINT"[SHFT CLR][CRSR DN][CRSR DN][22 SHFT FS]"
304 PRINT"       SEARCH       "
305 PRINT"[22 SHFT DS]":PRINT
306 INPUT"WANT A PRINTOUT";PO$
307 INPUT"RECORD NO. = O[CRSR LF][CRSR LF][CRSR LF]";F
308 IF F=0 THEN PO$="N"
309 IFF>200THEN307
310 IFF=0THEN50
315 IFI$(F)<>"1"THEN307
325 GOSUB5100
340 IF PO$="Y" THEN OPEN 4,4
342 IF PO$="Y" THEN CMD 4
360 PRINT"   ";SUR$", "GIV$
361 PRINT"   ";ID$
362 PRINT:PRINT
363 PRINT"TEST 1  "AXA
365 PRINT"TEST 2  "BXB
366 PRINT"TEST 3  "CXC
370 PRINT"FINAL  "FEX
372 PRINT"HOMEWORK  "HW
373 CUM=W1*AXA+W2*BXB+W3*CXC+WF*FEX+WHW*HW
375 PRINT"CUMULATIVE  ";CUM
380 IF GRD$="Y"THEN GOSUB 6000
381 IFGRD$="Y"THEN PRINT"COURSE GRADE: "G$
385 PRINT"---------------------":PRINT
386 IFPO$<>"Y"THEN390
387 PRINT#4:CLOSE4
390 GOTO307
1100 REM  **********************
1101 REM  * GRADE CUTOFF COMP  *
1102 REM  **********************
1110 INPUT"LOWEST D  ";LD
1115 INPUT"LOWEST C  ";LC
1120 INPUT"LOWEST C+ ";LP
1125 INPUT"LOWEST B  ";LB
1130 INPUT"LOWEST B+ ";LQ
1135 INPUT"[SHFT L]OWEST A  ";LA
1140 RETURN
1300 REM   ******************
1301 REM   * ROSTER LISTING  *
1302 REM   ******************
1303 PRINT"[SHFT CLR]":PRINT:PRINT:PRINT:PRINT:PRINT"RO
     STER?  (Y OR N)"
1305 GETM$:IFM$=""THEN1305
1306 IFM$="N"THEN RETURN
1307 IFM$="Y"THEN1310
1308 GOTO1303
1310 PRINT:PRINT:PRINT"HARD COPY WANTED?  (PRESS R WHEN
     DONE)"
```

More →

Course Choices

There are five options on the main job menu: create/update file, delete file, search, summary and exit program. The most important option, the create/update, asks you to designate a file number from 1 to 200. If the number corresponds to an inactive file, as recorded by the file index, the message Creating New File appears, along with the file number, and you'll be asked for the last name, first name, ID number, test scores for exams 1, 2, 3 and the final exam.

The ID number can be any character string. If you don't use ID numbers or haven't any exam data as yet, you merely hit return when prompted, which leaves zero as default value. Once you've input a new file, the information is written to disk and you're asked to designate a new file number.

When you designate an active file number for create/update, the process is somewhat different. The information existing in that file appears on the screen and you're asked whether you do want to update that particular file. If N, you're once more asked for a file number. If Y, you are prompted for each piece of information. When all inputs are complete, the new data is written to disk and you are asked for a new file number.

Finally, when you're asked for a file number and you return zero, the program exits the create/update routine. The index file on the disk is then updated and you return to the roster option that, when declined, leads back to the main job menu.

The delete option asks you for a file number. If you input an active number, the delete process simply changes the index flag for that file number from active to inactive. You are then asked for another file number to repeat the process. Returning the prompted zero returns you to the roster option.

The search option first asks you if you want a hard copy; if so, each file you search in this sequence will be fully printed out. You are then asked for a file number. When you designate an active file, you obtain a display or printout of name, ID number, test and homework scores, cumulative score based on the current weights and, if the grade-assignment option was selected when the program was begun, an assigned letter grade. Upon completing one display or printout, the program asks for the next file to be searched. Pressing zero returns you to the roster option.

Upon choosing the summary option, you will see the screen display WAIT A MINUTE. The delay is necessary, since the data from all active files is being read and cumulative scores tabulated. This completed, the summary menu appears: (1) median, mean, standard deviation; (2) letter grade distribution; (3) letter grade separation; (0) return to roster option.

Option 1 results in another Wait a Minute message. This is because computation of the median of an unordered collection of raw figures requires quite a bit of combinatorial shuffling. The screen eventually displays the median, the mean and the standard deviation of the cumulative scores.

Just to remind you, the median is the middle one of a group of scores. If the total number of scores is even, so that no one is exactly in the middle, then you take the median to be the average of the two scores on either side nearest the middle. The mean, on the other hand, is just the average of all the scores. Comparing median and mean (they will often be quite close) gives you some idea of how the scores are distributed along the scale.

The standard deviation is the square root of the average of the squares of the individual deviations. (An individual deviation is the difference between an individual score and the mean.) The standard deviation gives some measure of how tightly or loosely the scores are grouped around the mean.

Choosing options 2 or 3 from the summary menu assumes that you initially elected letter grade assignments and that you entered grade cutoffs. Option 2 merely displays the total number of grades in each category, A through F. The actual numbers are displayed on the screen along with a multi-colored bar graph (A is red, F is black) that visually summarizes the same information.

Option 3 displays the highest and lowest existing cumulative scores within each letter grade category. This option has been included on the assumption that it's better if the set of cumulative scores within each letter grade category is somewhat clearly grouped. If, for instance, the highest C+ in the class differs from the lowest B by only a point or two out of, say, 600, the grade separation option lets you see this immediately.

Note that you may return to the summary menu by hitting R after running any of these three options.

If you are unhappy with some aspect of the cumulative score or letter grade

Listing 1 continued.

```
1311 GETZ$:IFZ$=""THEN1311
1312 IFZ$="N"THEN 1324
1313 IFZ$="Y"THEN 1330
1314 GOTO1311
1316 REM
1324 PRINT:PRINT:PRINT"D TO DISPLAY ROSTER":PRINT
1325 PRINT:PRINT"W TO KEEP DISPLAY"
1326 PRINT:PRINT"R TO UPDATE FILES OR EXIT"
1327 GETR$:IFR$<>"D"THEN1327
1330 FOR F=1TO200
1332 IFI$(F)<>"1"THEN1355
1333 GOSUB5100
1334 CUM=W1*AXA+W2*BXB+W3*CXC+WF*FEX+WHW*HW
1335 IFGRD$="Y"THENGOSUB6000
1336 LE$=" "
1337 IFGRD$="Y"THENLE$=G$
1338 IFZ$="Y"THENOPEN4,4:CMD4
1340 PRINTTAB(2)FSPC(3)CUMSPC(2)LE$SPC(3)SUR$", "GIV$CH
     R$(13)
1345 IFZ$="Y"THENPRINT#4:CLOSE4:GOTO1355
1349 FORZ=1TO300:NEXT
1350 GETE$:IFE$<>"W"THEN 1355
1352 IFE$="W"THEN GOTO 1400
1355 NEXT
1400 GETQ$:IFQ$<>"R"THEN1400
1403 IFQ$="R"THEN1405
1405 SUR$=" ":GIV$=" ":ID$=" "
1410 AXA=0:BXB=0:CXC=0:FEX=0:HW=0
1415 RETURN

1500 REM   ***************************
1501 REM   * FILE CHECK & UPDATE     *
1502 REM   ***************************
1510 IFI$(F)<>"1"THEN1600
1515 GOSUB5100
1520 PRINT"[CTRL 3]"
1521 PRINT"[SHFT CLR]"
1523 PRINTF"    "SUR$"  "GIV$

1524 PRINT"        "ID$
1525 PRINT"TEST 1  "AXA,"TEST2    "BXB,"TEST 3    "CXC
1526 PRINT"  FINAL "FEX"        HW "HW
1529 PRINT:PRINT"   * TO LEAVE UNCHANGED"
1531 PRINT  "--------------------------------"
1532 PRINT"[CTRL 1]"
1535 INPUT"CHANGE (Y OR N) ";UN$
1537 IF UN$<>"Y"THENRETURN
1539 INPUT"SURNAME ";CS$
1541 IFCS$="*"THEN1545
1543 SUR$=CS$
1545 INPUT"FIRST NAME";CG$
1547 IFCG$="*"THEN1551
1549 GIV$=CG$
1551 INPUT"I.D. NUMBER";CI$
1553 IFCI$="*"THEN1557
1555 ID$=CI$
1557 INPUT"CHANGE/ENTER TEST 1";AZ$
1559 IFAZ$="*"THEN1563
1561 AXA=VAL(AZ$)
1563 INPUT"CHANGE/ENTER TEST 2";BZ$
1565 IF BZ$="*"THEN 1569
1567 BXB=VAL(BZ$)
1569 INPUT"CHANGE/ENTER TEST 3";CZ$
1571 IFCZ$="*"THEN1575
1573 CXC=VAL(CZ$)
1575 INPUT"CHANGE/ENTER FINAL";CF$
1577 IFCF$="*"THEN1581
1579 FEX=VAL(CF$)
1581 INPUT"CHANGE/ENTER HW";CW$
1583 IFCW$="*"THEN 1586
1585 HW=VAL(CW$)
1586 GOSUB5200
1587 I$(F)="1"
```

More →

Listing 1 continued.

```
 1589 RETURN
 1600 PRINT"[SHFT CLR]":PRINT"      CREATING NEW RECORD"
 1601 SUR$=" ":GIV$=" ":ID$=" "
 1602 AXA=0:BXB=0:CXC=0:FEX=0:HW=0
 1605 PRINT:PRINT"RECORD #"F:PRINT
 1610 INPUT"LAST NAME    ";SUR$
 1615 INPUT"FIRST NAME   ";GIV$
 1620 INPUT"I.D.  #      ";ID$
 1625 INPUT"TEST #1    ";AXA
 1630 INPUT"TEST #2    ";BXB
 1635 INPUT"TEST #3    ";CXC
 1640 INPUT"FINAL      ";FEX
 1645 INPUT"HOMEWORK   ";HW
 1650 GOSUB5200
 1655 I$(F)="1"
 1660 RETURN
 2000 REM    ***********************
 2001 REM    * OLD SHEET: WEIGHT   *
 2002 REM    * AND CUTOFF UPDATE   *
 2003 REM    ***********************
 2005 F=300:GOSUB5330
```

More →

distribution, you can try to rectify the situation by adjusting your formulas (i.e., by altering the weight factors and letter grade cutoffs). To do this, simply exit the program through the main job menu, run it again and put in the new weight and cutoff values when asked. Such adjustments are made easily and rapidly, and you can try many possibilities to achieve what you think is an equitable result.

Modifications

Once you understand the logic of this program, you should be able to modify it for your special needs. For instance, if you teach a course where papers, rather than exams, are your criteria, you might want to change designations in the various displays from Test and Exam to Paper. (Remember, grades on papers will then have to be numerical, or at least readily convertible into numbers.) Perhaps you'll want to change the number of exams, or even record every homework assignment separately. The fundamental design of this program will easily accommodate such modifications.

The same principle holds if you want to use other letter grades (A –, B –, etc.) in addition to those already built into the program. Here, however, you may want to make a modification of the grade distribution summary to get a visually attractive display.

If you have a VIC-20 rather than a C-64, the Basic logic will work easily, provided that you have a large enough memory expansion board (remember you need more than 20K of working space). The only Poke statement in the program (line 12) sets screen color to white, and it is trivial to modify this for a VIC. However, since a few of the screen displays were devised with the C-64's 40-column screen in mind, you may have to modify them to look well on the VIC screen. R

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Listing 1 continued.

```
2006 PRINT#15,"U1:";CH;FD;FT;FS
2007 PRINT#15,"B-P:";CH;FP
2008 GOSUB5270
2011 INPUT#CH,W1
2012 INPUT#CH,W2
2013 INPUT#CH,W3
2014 INPUT#CH,WF
2015 INPUT#CH,WHW
2018 PRINT"[SHFT CLR]":PRINT
2019 INPUT"KEEP WEIGHTS";K$
2020 IFK$="Y"THEN2070
2021 IFK$<>"N"THEN2018
2022 PRINT"[CTRL 3]"
2023 PRINT"TEST 1      "W1:PRINT"TEST 2      "W2
2024 PRINT"TEST 3      "W3:PRINT"FINAL       "WF
2026 PRINT"HOMEWORK    "WHW
2028 PRINT:PRINT"  ----------------------------------
     "


2029 PRINT"[CTRL 1]"
2030 INPUT"CHANGE WEIGHTS";K$
2032 IFK$="N"THEN2070
2035 INPUT"TEST 1";W1
2036 INPUT"TEST 2";W2
2037 INPUT"TEST 3";W3
2038 INPUT"FINAL";WF
2039 INPUT"HOMEWORK";WHW
2040 GOSUB2840
2070 IFGRD$<>"Y"THEN46
2071 PRINT"[SHFT CLR]":PRINT"Y TO UPDATE CUTOFFS OR ENT
     ER"
2072 PRINT"FOR THE FIRST TIME."
2075 INPUT"OTHERWISE N         ";K$
2080 IF K$="Y"THEN  2085
2081 IFK$<>"N"THEN2071
2083 GOTO2700
2085 F=400:GOSUB5330
2090 PRINT#15,"U1:";CH;FD;FT;FS
2095 PRINT#15,"B-P:";CH;FP
2097 GOSUB5270
2100 INPUT#CH,LD
2102 INPUT#CH,LC
2104 INPUT#CH,LP
2106 INPUT#CH,LB
2108 INPUT#CH,LQ
2110 INPUT#CH,LA
2115 PRINT"[SHFT CLR]":PRINT"[CTRL 3]"
2120 PRINT"    LOWEST D  "LD
2121 PRINT"    LOWEST C  "LC
2122 PRINT"    LOWEST C+ "LP
2123 PRINT"    LOWEST B  "LB
2124 PRINT"    LOWEST B+ "LQ
2125 PRINT"    LOWEST A  "LA
2130 PRINT:PRINT"  ----------------------------------
     ":PRINT"[CTRL 1]"
2135 INPUT"CHANGE LETTER-GRADE CUTOFFS";K$
2136 IF K$="N"THEN 46
2140 INPUT"NEW LOWEST D ";LD
2141 INPUT"NEW LOWEST C ";LC
2142 INPUT"NEW LOWEST C+";LP
2143 INPUT"NEW LOWEST B ";LB
2144 INPUT"NEW LOWEST B+";LQ
2145 INPUT"NEW LOWEST A ";LA
2150 GOSUB 2940
2155 GOTO46
2200 REM    *********************
2201 REM    * NEW SHEET:        *
2202 REM    * WEIGHTS & CUTOFFS *
2203 REM    *********************
2204 FORF=1TO200:I$(F)="/":NEXT
2205 F=300:GOSUB5330
2210 PRINT"[SHFT CLR]"
```

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Density 0203
Life Expec.(16K) 0204
Zodiac(16K) 0205

SET C: 16K Social Studies
States & Capitals 16K 0301
Geography(16K) 0302
Hawaii(16K) 0303
Presidents Quiz(16K) 0304
World Capitals(16K) 0305

SET D: Language
Spelling 0401
Scramble Word(16K) 0402
Letter Squares(16K) 0403
Contractions #2 0404
Syno/Anonims 0405

SET E: Home-Management
Home Budget 0501
Inventory 0502
Investments 0503
Income Exp.Budget 0504
Phone Directory 0505

SET F: Home-Management
Mail List 0506
Sheet Music 0507
Check Book 0508
Loan Calcul 0509
Decisi./Maker 0510
Address Book 0511

SET G: Space Games
Star Wars 0601
Asteroids 0602
Invaders 0603
Lunar Lander 0604
Star Chaser 0605

SET H: Gambling Games
Acie Ducie Game 0606
Bandit #1 0607
Solitaire Poker 0608
Quick Draw 0609
Vic Slots 0610

SET I: Maze Games
Paackman 0611
Maze Chase 0612
Tele-Mazeman 0613
Dragon Maze 0614
Maze(16K) 0615

SET J: Auto Racing
Grand Prix 0616
Forest Driver 0617
Trail Ride 0618
Car Race 0619
Road Race 0620

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Listing 1 continued.

```
2215 PRINT:PRINT    "ENTER DESIRED TEST WEIGHTS":PRINT:
     PRINT
2220 INPUT"  TEST 1 ";W1
2221 INPUT"  TEST 2 ";W2
2222 INPUT"  TEST 3 ";W3
2223 INPUT"   FINAL ";WF
2224 INPUT"HOMEWORK ";WHW
2225 F=300:GOSUB5330
2230 GOSUB2840
2240 IFGRD$<>"Y"THENLD=0:LC=0:LP=0:LB=0:LQ=0:LA=0:GOTO2
     270
2250 PRINT"[SHFT CLR]":PRINT
2255 PRINT"     ENTER DESIRED GRADE CUTOFFS":PRINT:PRIN
     T
2260 INPUT" LOWEST D ";LD
2261 INPUT" LOWEST C ";LC
2262 INPUT" LOWEST C+";LP
2263 INPUT" LOWEST B ";LB
2264 INPUT" LOWEST B+";LQ
2265 INPUT" LOWEST A ";LA
2270 F=400:GOSUB5330
2280 GOSUB2940
2290 GOTO51
2500 REM CLOSING FILE
2520 CLOSE2:CLOSE5:CLOSE15:END
2700 REM *CUTOFF READ-IN FOR OLD SHEET*
2705 F=400:GOSUB5330
2710 PRINT#15,"U1:";CH;FD;FT;FS
2715 PRINT#15,"B-P:";CH;FP
2720 GOSUB5270
2725 INPUT#CH,LD
2727 INPUT#CH,LC
2729 INPUT#CH,LP
2731 INPUT#CH,LB
2733 INPUT#CH,LQ
2735 INPUT#CH,LA
2740 GOTO46
2840 REM   *********************
2841 REM   * FILE TEST WEIGHTS *
2842 REM   *********************
2843 F=300:GOSUB5330
2845 PRINT#15,"B-P:";CH;FP
2851 PRINT#CH,W1
2852 PRINT#CH,W2
2853 PRINT#CH,W3
2854 PRINT#CH,WF
2855 PRINT#CH,WHW
2860 PRINT#15,"U2:";CH;FD;FT;FS
2865 GOSUB5270
2870 RETURN
2940 REM   ********************
2941 REM   * FILE GRADE CUTOFF *
2942 REM   ********************
2943 F=400:GOSUB5330
2945 PRINT#15,"B-P:";CH;FP
2950 PRINT#CH,LD
2951 PRINT#CH,LC
2952 PRINT#CH,LP
2953 PRINT#CH,LB
2954 PRINT#CH,LQ
2955 PRINT#CH,LA
2960 PRINT#15,"U2:";CH;FD;FT;FS
2965 GOSUB5270
2970 RETURN
3000 REM    ***************
3001 REM    *  SUMMARY    *
3002 REM    ***************
3006 KT=0:FORF=1TO200:U(F)=0:NEXT
3007 PRINT"[SHFT CLR]":PRINT:PRINT:PRINT"  WAIT A MINUT
     E!"
3008 FOR F=1TO200
3010 IFI$(F)="1"THENKT=KT+1
3015 IFI$(F)="/"THEN3050
3020 GOSUB5100
3040 CUM=W1*AXA+W2*BXB+W3*CXC+WF*FEX+WHW*HW
3045 U(F)=CUM
3050 NEXT
3059 PRINT"[SHFT CLR]"
3060 PRINT:PRINT"  1 = MEDIAN,  MEAN,  STD. DEV."
3065 PRINT:PRINT"  2 = LETTER GRADE DISTRIBUTION"
3067 PRINT:PRINT"  3 = LETTER GRADE SEPARATION"
3075 PRINT:PRINT"  0 = RETURN TO UPDATE ROUTINE"
3079 PRINT
3080 INPUT"1 , 2 , 3 , 0   1[CRSR LF][CRSR LF][CRSR LF]
     ";A$
3081 IF A$="1"THEN3100
3082 IF A$="2"THEN3300
3083 IF A$="3"THEN3500
3085 IF A$="0"THEN CH=2:GOTO50
3090 GOTO3059
3100 REM ***** STATISTICS *****
3101 PRINT"[SHFT CLR]":PRINT:PRINT:PRINT"  WAIT A MINUT
     E!"
3105 FORT=0TO2000:HZ(T)=0:NEXT
3107 FORF=1TO200
3110 IF I$(F)<>"1"THEN3115
3112 X=INT(2*U(F)):HZ(X)=HZ(X)+1
3115 NEXT
3120 HH=0
3122 FORJ=0TO2000
```

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Listing 1 continued.

```
3125 HL=HH:HH=HH+HZ(J)
3127 IFHH>KT/2ANDHL<KT/2THEN3140
3130 IFHH=KT/2ANDHL<HHTHENMK=J
3133 IFHH>KT/2ANDHL=KT/2THEN3142
3135 NEXT
3140 MD=J/2:GOTO3165
3142 MD=(J+MK)/4:GOTO3165
3165 SM=0:FORV=1TO200
3167 SM=SM+U(V):NEXT
3170 MN=SM/KT
3175 DV=0:FORV=1TO200
3177 DV=DV+(U(V)-MN)[UP ARROW]2
3180 SD=(DV/KT)[UP ARROW].5
3185 PRINT"[SHFT CLR]"
3190 PRINT:PRINT:PRINT"   STATISTICAL SUMMARY"
3200 PRINT:PRINT:
3203 PRINT"  MEDIAN  "MD:PRINT:PRINT
3205 PRINT"  MEAN   "MN"
3207 PRINT:PRINT" STD. DEV "SD
3210 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
3212 PRINT"  HIT R TO RETURN TO SUMMARY MENU"
3215 GETR$:IFR$<>"R"THEN3215
3220 IFR$="R" THEN 3059
3300 REM ***** GRADE DISTRIBUTION *****
3302 PRINT"[SHFT CLR]":PRINT:PRINT:PRINT"  WAIT A MINUT
     E!"
3305 FF=0:DD=0:CC=0:PP=0:BB=0:QQ=0:AA=0
3310 FORZ=1TO200:CUM=U(Z)
3312 IFI$(Z)="/"THEN3333
3315 GOSUB6000
3320 IFG$="F"THENFF=FF+1
3322 IFG$="D"THENDD=DD+1
3323 IFG$="C"THENCC=CC+1
3324 IFG$="C+"THENPP=PP+1
3326 IFG$="B"THENBB=BB+1
3328 IFG$="B+"THENQQ=QQ+1
3330 IFG$="A"THENAA=AA+1
3333 NEXT
3335 SC=1:IFKT<100THENSC=2
3340 PRINT"[SHFT CLR]"
3347 PRINT"[CTRL 3]" : LTH=SC*AA:GOSUB3400
3348 PRINT"TOTAL A'S  "AA:PRINT"[CRSR UP]"
3352 PRINT"[CTRL 4]":LTH=SC*QQ:GOSUB3400
3353 PRINT"TOTAL B+'S  "QQ:PRINT"[CRSR UP]"
3357 PRINT"[CTRL 5]":LTH=SC*BB:GOSUB3400
3358 PRINT"TOTAL B'S  "BB:PRINT"[CRSR UP]"
3362 PRINT"[CTRL 6]":LTH=SC*PP:GOSUB3400
3363 PRINT"TOTAL C+'S  "PP:PRINT"[CRSR UP]"
3367 PRINT"[CTRL 7]":LTH=SC*CC:GOSUB3400
3368 PRINT"TOTAL C'S  "CC:PRINT"[CRSR UP]"
3372 PRINT"[CTRL 8]":LTH=SC*DD:GOSUB3400
3373 PRINT"TOTAL D'S  "DD:PRINT"[CRSR UP]"
3377 PRINT"[CTRL 1]":LTH=SC*FF:GOSUB3400
3378 PRINT"TOTAL F'S  "FF:PRINT"[CRSR UP]"
3380 PRINT:PRINT:PRINT"    HIT R FOR SUMMARY MENU"
3382 GETR$:IFR$<>"R"THEN3382
3385 GOTO3059
3400 W=INT(LTH/2):E=2*(LTH-W)
3402 IFLTH=0THENPRINT"[CTRL 1]":RETURN
3403 PRINT"[CRSR UP]"
3405 FORJ=1TOW:PRINT"[CTRL 9] [CTRL 0]";:NEXT
3410 IF E=1THENPRINT"[COMD K]";
3415 PRINT"[CTRL 1]"
3420 RETURN
3500 REM  ***** GRADE SEPARATION *****
3502 PRINT"[SHFT CLR]":PRINT:PRINT:PRINT"  WAIT A MINUT
     E!"
3503 AH=10[UP ARROW]6:QH=LA-1:BH=LQ-1:PH=LB-1:CH=LP-1:D
     H=LC-1:FH=LD-1
3505 AG=LA:QG=LQ:BG=LB:PG=LP:CG=LC:DG=LD:FG=0
3507 FORJ=1TO200
3510 CUM=U(J)
3515 IFI$(J)="/"THEN3560
3520 IFU(J)>LA-1ANDU(J)<AHTHENAH=U(J)
3522 IFU(J)<LA AND U(J)>QG THEN QG=U(J)
3524 IFU(J)>LQ-1ANDU(J)<QHTHENQH=U(J)
3526 IFU(J)<LQ AND U(J)>BG THEN BG=U(J)
3528 IFU(J)>LB-1ANDU(J)<BHTHENBH=U(J)
3530 IFU(J)<LB AND U(J)>PG THEN PG=U(J)
3532 IFU(J)>LP-1ANDU(J)<PHTHENPH=U(J)
3534 IFU(J)<LP AND U(J)>CG THEN CG=U(J)
3536 IFU(J)>LC-1ANDU(J)<CHTHENCH=U(J)
3538 IFU(J)<LC AND U(J)>DG THEN DG=U(J)
3540 IFU(J)>LD-1ANDU(J)<DHTHENDH=U(J)
3542 IFU(J)<LD AND U(J)>FG THENFG=U(J)
3560 NEXT
3570 VA=0:VQ=0:VB=0:VP=0:VC=0:VD=0:VF=0
3580 FORJ=1TO200
3585 IFI$(J)="/"THEN3605
3588 CUM=U(J)
3590 GOSUB6000
3592 IFG$="A"THENVA=1
3594 IFG$="B+"THENVQ=1
3596 IFG$="B"THENVB=1
3598 IFG$="C+"THENVP=1
3600 IFG$="C"THENVC=1
3602 IFG$="D"THENVD=1
3604 IFG$="F"THENVF=1
3605 NEXT
3607 PRINT"[SHFT CLR]"
```

More

Listing 1 continued.

```
3610 IFVA=1THENPRINT"LOWEST  A  "AH
3612 IFVQ=1THENPRINT"HIGHEST B+ "QG
3615 IFVQ=1THENPRINT"LOWEST  B+ "QH
3617 IFVB=1THENPRINT"HIGHEST B  "BG
3620 IFVB=1THENPRINT"LOWEST  B  "BH
3622 IFVP=1THENPRINT"HIGHEST C+ "PG
3625 IFVP=1THENPRINT"LOWEST  C+ "PH
3627 IFVC=1THENPRINT"HIGHEST C  "CG
3630 IFVC=1THENPRINT"LOWEST  C  "CH
3632 IFVD=1THENPRINT"HIGHEST D  "DG
3635 IFVD=1THENPRINT"LOWEST  D  "DH
3640 IFVF=1THENPRINT"HIGHEST F  "FG
3670 PRINT:PRINT" HIT R FOR SUMMARY MENU"
3675 GETR$:IFR$<>"R"THEN3675
3680 GOTO3059
5100 REM ***********************
5105 REM * FDD BLOCK READ      *
5108 REM ***********************
5110 GOSUB5330
5120 PRINT#15,"U1:";CH;FD;FT;FS
5130 PRINT#15,"B-P:";CH;FP
5140 GOSUB5270
5150 INPUT#CH,SUR$
5152 INPUT#CH,GIV$
5153 INPUT#CH,ID$
5154 INPUT#CH,AXA
5155 INPUT#CH,BXB
5156 INPUT#CH,CXC
5157 INPUT#CH,FEX
5158 INPUT#CH,HW
5190 RETURN
5200 REM ***********************
5201 REM * FDD BLOCK WRITE     *
5202 REM ***********************
5210 GOSUB5330
5220 PRINT#15,"B-P:";CH;FP
5230 PRINT#CH,SUR$
5231 PRINT#CH,GIV$
5232 PRINT#CH,ID$
5233 PRINT#CH,AXA
5234 PRINT#CH,BXB
5235 PRINT#CH,CXC
5236 PRINT#CH,FEX
5237 PRINT#CH,HW
5240 PRINT#15,"U2:";CH;FD;FT;FS
5250 GOSUB5270
5260 RETURN
5270 REM ***********************
5275 REM *  ERROR CHECK        *
5278 REM ***********************
5280 INPUT#15,EN,EM$,ET,ES
5290 IFEN=0THENRETURN
5300 PRINT"ERROR STATUS:";EN;EM$;ET;ES
5310 INPUT"CONTINUE?";Y$:IFY$="Y"THENRETURN
5320 STOP
5322 REM ***********************
5324 REM * SET TRACK & SECTOR  *
5326 REM ***********************
5330 IFF<358THENF1=0:F2=22:F3=1:GOTO5370
5340 IFF>357ANDF<472THENF1=357:F2=20:F3=19:GOTO5370
5350 IFF>471ANDF<580THENF1=471:F2=19:F3=25:GOTO5370
5360 IFF>579THENF1=579:F2=18:F3=31
5370 FT=INT(((F-F1)-1)/(F2-1))+F3
5380 FS=F-F1-(FT-F3)*F2+(FT-F3-1)
5390 RETURN
6000 REM  *********************
6001 REM  * LETTER GRADE COMP *
6002 REM  *********************
6020 G$="F"
6121 IF CUM>LD-1THENG$="D"
6122 IF CUM>LC-1THENG$="C"
6123 IF CUM>LP-1THENG$="C+"
6124 IF CUM>LB-1 THENG$="B"
6125 IF CUM>LQ-1 THENG$="B+"
6126 IF CUM>LA-1THEN G$="A"
6130 RETURN
7000 REM  ***************
7005 REM  * LISTING     *
7010 REM  * CONVENTIONS *
7015 REM  ***************
7020 REM  "[CRSR UP]" CURSOR UP
7025 REM  "[CRSR DN]" CURSOR DOWN
7030 REM  "[CRSR LF]" CURSOR LEFT
7035 REM  "[CRSR RT]" CURSOR RIGHT
7040 REM  "[HOME]" CURSOR HOME
7045 REM  "[SHFT CLR]" CLEAR SCREEN
7050 REM  "[CTRL 9]" REVERSE ON
7055 REN  "[CTRL 0]" REVERSE OFF
7060 REM  "[SHFT SPACE]" SHIFTED SPACE
7065 REM  "[CTRL 1]" BLACK
7070 REM  "[CTRL 2]" WHITE
7075 REM  "[CTRL 3]" RED
7080 REM  "[CTRL 4]" CYAN
7085 REM  "[CTRL 5]" PURPLE
7090 REM  "[CTRL 6]" GREEN
7095 REM  "[CTRL 7]" BLUE
7100 REM  "[CTRL 8]" YELLOW
7105 REM  "[SHFT D]" SHIFTED D
7110 REM  "[SHFT F]" SHIFTED F
```

Spriten Up!

Take the tedium out of programming sprite graphics. This C-64 program simplifies the process.

By Edward Rager

The capacity to create and manipulate sprites is a powerful feature of the Commodore 64. However, there's a lot of work involved in doing it. Probably the most tedious aspect of sprite graphics is translating the binary data from the sprite you draw into decimal numbers that can be Poked into memory.

The program described here allows you to draw an enlarged version of your sprite on the screen. The computer will scan the diagram, calculate the numbers to be Poked into memory and display your sprite.

How to Draw a Sprite

The C-64 user's guide gives a detailed description of how to create a sprite. Essentially, you fill in the spaces of a grid. A 1 goes in a space you want to have filled in, and a 0 goes in a space to be left blank. There are 21 rows and 24 columns. The 24 columns are divided into three 8-bit binary words.

So 21 rows, composed of three 8-bit words each, make 63 words that describe your sprite. When converted into decimal values and Poked into memory, the sprite can be displayed on the screen.

Once you have entered the program, typing RUN will draw the sprite borders on the screen. (There won't be any grid lines.) The program will stop here to let you draw a sprite within the borders. Use the cursor arrows to move the cur-

Run It Right

Commodore 64

Address author correspondence to Edward Rager, 9360 Tasmania Ave., Baton Rouge, LA 70810.

Listing 1. Sprite graphics program.

```
20 REM DRAW THE ORIGINAL BORDERS BY TYPING RUN
25 REM TYPE GOTO 200: TO SAVE THE PICTURE AND DRAW SPRITE
30 REM TYPE GOTO 500: TO LIST THE DATA ON THE SCREEN
35 REM TYPE GOTO 600: TO REDRAW AND MODIFY THE PICTURE
40 REM TYPE GOTO 700: TO LIST DATA TO THE PRINTER
45 DIM AR(504),A1(63): V=53248
100 GOSUB1000
150 END
200 GOSUB 1200
300 GOSUB 1300
400 GOSUB 1400
450 END
500 GOSUB 1500
510 IF P1=1 THEN PRINT#1 : P1=0 : CLOSE 1 : REM P1=ZERO
550 END
600 GOSUB 1600
650 END
700 P1=1
710 OPEN 1,4 : CMD 1
720 GOTO 500
800 REM
1000 REM SET UP INFORMATION FOR BORDERS
1010 PRINT"[SHFT CLR]"
1020 S=1034 : S1=1057 : S2=1 : S3=100 : GOSUB 1100
1030 S=1073 : S1=1873 : S2=40 : S3=103 : GOSUB 1100
1040 S=1914 : S1=1937 : S2=1 : S3=99 : GOSUB1100
```

More →

sor to a position you want filled in and put a 1 there. It is not necessary to put a 0 in spaces you want left blank, for the computer looks only for 1s.

When the drawing is complete, type GOTO200: with the cursor at the left margin of the screen and about halfway from the top. (In typing in these program commands, be sure to include each colon. If any are omitted, syntax errors will result.) Your drawing will be scanned and converted to decimal, and the values put into arrays. (For about 20 seconds, it will look as though nothing is happening.) Your sprite will then be displayed as it would look in a program.

The program pauses again, and if you like the sprite, you can get a listing of the 63 decimal values that you can Poke into memory to display the sprite in a program of your own. Typing GOTO500: will put the list on the screen. GOTO700: will send it to the printer. Both lists are read across.

If you're not satisfied, and want to modify the sprite, do so. Then type GOTO200: to put the new values into the arrays and to display the revised version.

By typing GOTO600:, you can always have the computer redraw the picture for you. It will use the data in the arrays to do this. No matter what you do to the drawing, the array data won't change until GOTO200: is typed. Of course, typing RUN will erase it. Table 1 summarizes the action of the GOTO commands.

How the Program Works

This program works by the position of the drawing on the screen. If the screen should scroll up even one row, all the values for the sprite would be wrong. You must be careful to keep the cursor away from the bottom of the screen; that's why you should enter the GOTO commands about halfway from the top. The reason the GOTOs are followed by a colon is to keep the computer from trying to read the whole line, which includes part of your sprite drawing.

Line 45 dimensions the two arrays used and sets V equal to the start of the video display chip. Lines 100 through 720 call the subroutines that do the work of the program.

Subroutines 1000 and 1100 make the borders for the sprite drawing. Subroutine 1200 scans the area within the borders. If a 1 is found, it puts a 1 in the corresponding element of array AR. Otherwise, it puts a 0 in the array location. There are 504 (3 × 8 × 21) elements

Command	Action
GOTO200:	Scan the sprite drawing, convert it to decimal values and store them in an array. Display sprite.
GOTO500:	List the 63 decimal values on the screen. Read across the rows.
GOTO600:	Redraw the current sprite.
GOTO700:	List the 63 decimal values on the printer. Read across the rows.

Table 1. Summary of GOTO commands in sprite drawing program.

Listing 1 continued.

```
1050 S=1098 : S1=1937 : S2=40 : S3=101 : GOSUB1100
1060 S=1034 : POKE S+7,122 : POKE S+8,76
1065 POKE S+15,122 : POKE S+16,76
1070 S=1914 : POKE S+7,80 : POKE S+8,79
1075 POKE S+15,80 : POKE S+16,79
1080 S=1472 : POKE S,67 : POKE S+27,67
1090 RETURN
1100 REM  DRAW BORDERS
1110 FOR I=S TO S1 STEP S2
1120 :    POKE I,S3
1130 NEXT I
1140 RETURN
1150 REM
1200 REM  PUT BIT DATA IN ARRAY AR()
1210 I1=0 : REM  I1=ZERO
1220 FOR S=1074 TO 1874 STEP 40
1230 :   FOR I=S TO S+23
1240 :        I1=I1+1
1250 :        AR(I1)=0 : REM AR(I1)=ZERO
1260 :        IF PEEK(I)=49 THEN AR(I1)=1
1270 :   NEXT I
1280 NEXT S
1290 RETURN
1295 REM
1300 REM  DECODE & PUT DECIMAL DATA IN ARRAY A1()
1310 Y=1
1320 FOR I=1 TO 63
1330 :   DEC=0 : BIN=128 : REM  DEC=ZERO
1340 :   FOR IX=Y TO Y+7
1350 :       DEC=DEC+BIN*AR(IX)
1360 :       BIN=BIN/2
```

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Listing 1 continued.

```
1370 :   NEXT IX
1380 :   Y=Y+8 : A1(I)=DEC
1390 NEXT I
1395 RETURN
1397 REM
1400 REM  DRAW THE SPRITE
1410 FOR I=1 TO 63
1420 :   POKE 831+I,A1(I)
1430 NEXT I
1440 POKE V+4,70 : POKE V+5,205
1450 POKE 2042,13 : POKE V+21,4
1460 RETURN
1470 REM
1500 REM  LIST DATA
1510 PRINT"[SHFT CLR]" : POKE V+21,0 : REM POKE V+21,ZERO
1520 FOR I=1 TO 63 STEP 3
1530 :   PRINT A1(I),A1(I+1),A1(I+2)
1540 NEXT I
1550 RETURN
1560 REM
1600 REM  REDRAW PICTURE
1610 GOSUB 1000
1620 I1=0 : REM I1=ZERO
1630 FOR S=1074 TO 1874 STEP 40
1640 :   FOR I=S TO S+23
1650 :       I1=I1+1
1660 :       IF AR(I1)=1 THEN POKE I,49
1670 :   NEXT I
1680 NEXT S
1690 RETURN
```

in array AR.

Subroutine 1300 takes the binary data from array AR, eight elements at a time, and treats this as an 8-bit binary number. This is converted to its decimal equivalent and is stored as one of the 63 words in array A1.

Subroutine 1400 displays the sprite. The 63 decimal numbers from array A1 are Poked into memory, starting at location 832. (Locations 828 to 1019 comprise the tape I/O buffer.) 832 is 64×13, so that with blocks of 64, this data is stored in the 13th block.

In line 1450, 2042 is the location that points to the data for sprite 2. The 13 is Poked into it because the data was put into the 13th block.

Location V+21 enables (displays on the screen) a sprite. In this case, it turns on sprite 2 since a 4 (2×2) was Poked in. Line 1440 specifies the horizontal and vertical position of the sprite.

Subroutine 1500 lists the 63 decimal numbers that can be used to define a sprite in a program.

Subroutine 1600 takes the binary data from array AR and redraws the picture on the screen so it can be reviewed and modified if desired.

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Reach Out And Touch-Tone Someone

Teach your C-64 to touch-tone dial and impress your non-computer friends at the same time with this practical application for your computer.

By Jim Grubbs

RUN It Right
Commodore 64
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Address author correspondence to Jim Grubbs, PO Box 3042, Springfield, IL 62708.

One way you can make your computer serve a really practical purpose is to connect it with the outside world. Some relatively simple interfacing makes possible this communications function.

I experimented with trying to make a touch-tone dialer, using the tones available with the VIC-20. This was unsuccessful, for I could not produce the needed seven tones accurately enough for dialing. However, the sound synthesis chip (SID) in the C-64 makes the dialer possible.

Unlike the VIC-20, where you're limited to a relatively few inaccurate tone frequencies, the C-64 provides a musically precise frequency over a wide range. With the C-64's SID, I was able to create a dual-tone, multi-frequency (DTMF) dialer that would stand alone with proper interfacing.

Although the program allows only nine menu-selected numbers, it can easily be modified to accommodate a large list. It can also be included in a terminal program for automatic dialing of databases such as CompuServe or your local BBS.

Keep in mind that although this program is designed for DTMF dialing, it could just as easily handle any tone combinations. This might be useful in doing remote control via telephone lines or radio in the event a high degree of security is necessary.

Let's look first at the structure of the DTMF dialing system, then at the method of implementing these tones in the C-64, and finally at how to get this all out on the phone lines.

DTMF Revealed

As I mentioned, DTMF stands for dual-tone, multiple-frequency dialing. As its name implies, each digit is identified by two tones sent simultaneously. Fig. 1 shows the arrangement for the tones. Note that there are three tones horizontally and four tones vertically.

In actuality, the phone companies have also reserved a fourth tone for the horizontal rows to give a total of sixteen combinations. Very few touchtone pads actually have these additional four buttons as yet, but the probability is that as the phone system uses more and more computer technology, additional hardware will appear for doing telephone keypad data entry. Electronic banking is one likely use.

Since you have three voices available in the C-64, you can handle the generation of two simultaneous tones with no

```
10 POKE 53280,0:POKE 53281,0:PRINT"[CTRL 2]"
20 PRINT"[SHFT CLR][CRSR DN][CRSR DN]ENTER THE FREQUENC
    Y (IN HERTZ)"
30 INPUT F0
40 F1=F0/.06097
50 F2=INT(F1/256)
60 F3=INT(F1-(256*F2)+.5)
70 PRINT "[CRSR DN][CRSR DN]THE VALUES ARE: "; "HIGH";
    F2; "LOW "; F3
80 PRINT"[CRSR DN][CRSR DN]ANOTHER FREQUENCY? (Y/N)"
90 INPUT Y$:IF Y$="Y" THEN 20
```

Listing 1. SID formula utility program.

problem. The next step is to compute the Poke values needed to set the C-64 to the proper DTMF frequencies.

The programmer's reference guide gives a somewhat cryptic formula for the computation of the necessary Poke values. It also includes a table that at first glance appears to give you the values for many different frequencies. A closer look reveals, however, that the number listed in the table is not the resultant audio frequency, but rather a value we'll call F1.

F1 is the frequency at which circuits within the C-64 must operate in order to produce your desired output frequency. The formula is F1 = Fout ÷ .06097. You must store the resultant value in a two-byte register, since you cannot get the entire value into one byte of memory. A little more mathematics produces the values for the high and low value Pokes.

To make life simple, a nine-line program is included to make these calculations for you quickly. You might want to save it as a utility program for future SID work. It's not needed to make the autodialer work, however.

The Main Event

Now that you know what frequencies you need, and how to calculate the values for the frequency Pokes, you can write your dialer program. A quick review of some basic SID principles is in order.

With the VIC, all you have to do is Poke the tone value into the desired voice memory location and turn on the volume. No such luck with the 64! It's a bit confusing at first, but the same things that make sound-programming complex on the C-64 are also the things that make the machine so versatile.

You need to set things like attack and decay, waveform, sustain and so on. Furthermore, you have to do these in the proper sequence, or the chip won't give the expected results. Line 200 of the program sets the values. It's interesting to note that with the C-64 you turn the waveform on and off (lines 202 and 210), rather than the volume as on the VIC.

In the program, line 2 sets up the screen; line 4 sets the values for your variables. Lines 6 and 8 contain the calculated results for the high and low components of the tone Pokes. In lines 300 to 400, you build the menu to select your numbers.

The numbers themselves are stored in lines 510 to 600. The menu and storage areas can easily be expanded to accommodate more numbers if you wish. Lines 10 to 220 contain the main body

	1209	1336	1477	1633@
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

@This frequency has been reserved for future use.

Table 1. The combination of frequencies (in Hertz) used to create the tones for any digit or character on the DTMF dialing pad.

Listing 2. Autodialer tone-generating program for the C-64.

```
2 POKE 53280,0:POKE 53281,0:PRINT"[CTRL 2]":X$=""
4 V=54296: V2=54272: V1=54273: V4=54286: V3=54287: POKE
    V,15
6 L1=44:L2=168:L3=49:L4=85:L5=54:L6=150:L7=60:L8=74
8 H1=77:H2=117:H3=85:H4=152:H5=94:H6=161
10 GOSUB 300:PRINT "[SHFT CLR][11 CRSR DNS][8 SPACES]DI
    ALING: "+X$
12 FOR Z=1TOLEN(X$)
20 X=VAL(MID$(X$,Z,1)):X1$=(MID$(X$,Z,1))
25 IF X1$=" " THEN FOR Y=1TO 100:NEXT Y:GOTO210
26 IF X1$="*" THEN GOTO 195
27 IF X1$="#" THEN GOTO 196
29 IF X=0 THEN GOTO 190
30 ON X GOTO100,110,120,130,140,150,160,170,180
100 POKE V1,L1:POKE V2,L2:POKE V3,H1:POKE V4,H2:GOTO 20
    0
110 POKE V1,L1:POKE V2,L2:POKE V3,H3:POKE V4,H4:GOTO 20
    0
120 POKE V1,L1:POKE V2,L2:POKE V3,H5:POKE V4,H6:GOTO 20
    0
130 POKE V1,L3:POKE V2,L4:POKE V3,H1:POKE V4,H2:GOTO 20
    0
140 POKE V1,L3:POKE V2,L4:POKE V3,H3:POKE V4,H4:GOTO 20
    0
150 POKE V1,L3:POKE V2,L4:POKE V3,H5:POKE V4,H6:GOTO 20
    0
160 POKE V1,L5:POKE V2,L6:POKE V3,H1:POKE V4,H2:GOTO 20
    0
170 POKE V1,L5:POKE V2,L6:POKE V3,H3:POKE V4,H4:GOTO 20
    0
180 POKE V1,L5:POKE V2,L6:POKE V3,H5:POKE V4,H6:GOTO 20
    0
190 POKE V1,L7:POKE V2,L8:POKE V3,H3:POKE V4,H4:GOTO 20
    0
195 POKE V1,L7:POKE V2,L8:POKE V3,H1:POKE V4,H2:GOTO 20
    0
196 POKE V1,L7:POKE V2,L8:POKE V3,H5:POKE V4,H6:GOTO 20
    0
200 POKE54277,0:POKE54278,128:POKE 54291,0:POKE 54292,1
    28:W1=54276:W2=54290:F=17
202 POKE W1,F:POKE W2,F
210 FORY=1TO30:NEXTY:POKEV1,0:POKE V2,0:POKEV3,0:POKEV4
    ,0:POKEW1,0:POKEW2,0
212 IF X1$=" " THEN POKE W1,0:POKE W2,0
215 NEXT Z:IF Z=LEN(X$)+1 THEN 10
220 GOTO 12
300 PRINT "[SHFT CLR]" SPC(10)"DIRECTORY "
310 PRINT SPC(10) "[CRSR DN][CTRL 9]1[CTRL 0] TIM"
320 PRINT SPC(10) "[CRSR DN][CTRL 9]2[CTRL 0] DONNA"
330 PRINT SPC(10) "[CRSR DN][CTRL 9]3[CTRL 0] TIME/TEMP
    ERATURE"
```

More

Listing 2 continued.

```
340 PRINT SPC(10) "[CRSR DN][CTRL 9]4[CTRL 0] NOAA WX"
350 PRINT SPC(10) "[CRSR DN][CTRL 9]5[CTRL 0] COMPUSERV
     E"
360 PRINT SPC(10) "[CRSR DN][CTRL 9]6[CTRL 0] TELENET"
370 PRINT SPC(10) "[CRSR DN][CTRL 9]7[CTRL 0] MOM AND D
     AD"
380 PRINT SPC(10) "[CRSR DN][CTRL 9]8[CTRL 0] COMMUNICA
     TOR"
390 PRINT SPC(10) "[CRSR DN][CTRL 9]9[CTRL 0] OTHER"
395 IF X$<>"" THEN PRINT SPC(10) "[CRSR DN]CURRENT NUMB
     ER IS:":PRINT:PRINT SPC(10) X$
400 GET R$:IF R$="" THEN 400
405 R=VAL(R$)
410 ON R GOSUB 510,520,530,540,550,560,570,580,590
420 RETURN
510 X$="5551234":RETURN
520 X$="5554321":RETURN
530 X$="7471212":RETURN
540 X$="4924949":RETURN
550 X$="5225101":RETURN
560 X$="7531373":RETURN
570 X$="13005556789":RETURN
580 X$="13123688000":RETURN
590 PRINT "[SHFT CLR][8 CRSR DNS]":PRINT SPC(12) "ENTER
      NUMBER":INPUT X$
600 IF X$="" THEN 590
610 RETURN
620 REM AUTODIALER
630 REM BY JIM GRUBBS
640 REM     PO BOX 3042
650 REM     SPRINGFIELD IL 62708
660 REM         1983
```

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> *You must notify the telephone company that you have installed a telephone coupler on your line.*

of the program. You turn on the tones in line 202 and turn them off in line 210.

Note that you can program the * and # tones and a space or silent period in addition to the digits one through zero. In telephone company terms, the zero is really ten. This is a throwback to pulse dials, where the zero actually sends ten pulses. Any illegal input will outpulse a zero.

Before You Say Hello

The final item for consideration is interfacing your C-64 to the phone line. Depending on your background, this will range from extremely simple to moderately difficult. I use a monitor cord and connect the audio plug to the input of an inexpensive telephone coupler.

In some cases, the output of the C-64 may not have enough "oompf" to drive the telephone coupler directly. Any kind of small, single-stage audio amplifier circuit will handle this chore nicely.

Note also that you'll be able to hear the tones in your TV set, if you have one hooked up to the C-64. It is possible (if you have a touch tone line) to use the dialer by simply holding the telephone handset near the TV speaker to acoustically couple the tones into the line. The volume should be adjusted so that when you dial, the tones break the dial tone consistently. Enlist the help of some of your friends to make sure you can reach their numbers properly.

Just as with your modem, to stay legal you must notify the telephone company that you have installed a telephone coupler on your line. They'll ask for the certification number and ringer equivalence. These items are normally printed directly on the coupler.

Keep in mind that if your coupler/computer combination causes problems on the phone line, you'll have to disconnect it. You shouldn't experience any trouble in this area if you've followed the instructions for your coupler.

So the next time your friends are bragging about their new "demon dialer" that they just spent this week's paycheck on, drag out your autodialer and show them how practical owning a computer can be! R

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Create a VICasso

With Custom Characters

You want to put more creativity into your programming, but your VIC-20's character set just doesn't satisfy your needs. Your only solution is to generate your own characters. Here are some valuable tips to help you design custom characters for your games and graphics with speed and ease.

By Stephen Erwin

If you're like most programmers interested in games or graphics, you sooner or later reach a point where the standard VIC-20 character set no longer satisfies your need for creativity. Although there are many interesting characters to choose from, your best solution when a game calls for spaceships or funny little men is to design a custom-made set of programmable characters.

Memory Moves

The basic techniques are fairly simple, but they do require a bit of background information before they can be understood. For starters, VIC-20 character memory is stored in ROM, which cannot be changed. Characters can be changed only when they are stored in the user RAM. Therefore, in order to create any new characters, the VIC character memory must first be moved into the limited locations in RAM that the VIC-20 video chip can access.

The standard locations on the unexpanded or 3K expanded VIC are at the top of user memory in 7168, 6144 or 5120. Location 7168 will store 64 characters; location 5120 will store all 255 characters. You move the character location by Poking location 36869 with the proper code. (See Table 1.)

When you choose a character location, it's important to remember that you must subtract the memory used by the character set from the RAM available for programming. While location 7168 uses only 512 bytes, location 5120, which allows 255 characters, uses 2560 bytes, leaving only 1024 bytes for the rest of the program. For this reason, it's important to use no more characters than you absolutely need.

Another important consideration is that the VIC stores some types of variables at the top of user memory. To protect your character set from these variables, you must Poke locations 52 and 56 with the proper code. Table 1 shows the codes for moving a character set and protecting it.

Try entering POKE56,28:POKE52,28:POKE36869,255. The screen should now be filled with junk. This is because, although you've moved and protected the character location, you haven't yet put any characters in it. To return the screen to normal, POKE36869,240.

The following routine will Peek the standard character location and move 64 characters to the new location at 7168.

```
10  POKE56,28:POKE52,28:CLR
20  FOR T=7168 TO 7679:
    POKE T,PEEK(T+(32768-7168)):NEXT
30  POKE36869,255
```

POKE 36869	LOCATION	POKE 52 AND 56
240	ROM MEMORY	
253	5120	20
254	6144	24
255	7168	28

Table 1. Codes for moving and protecting a character set.

RUN It Right
VIC-20

Address author correspondence to Stephen Erwin, 102 Hickory Court, Portland, IN 47371.

When this is entered, the only noticeable change is that the cursor disappears. This is because the screen Poke number of the reverse space that the cursor uses is 160, and the new character set contains only 64 characters.

To adjust this formula to move more characters, change the codes in lines 10 and 30 to the proper codes for the new location and substitute the new location for 7168 in line 20.

It's also possible to move individual characters into the new character set. Use the following formula, where X equals the screen Poke code of the character in ROM, and Y equals the screen Poke code of the character to be replaced.

```
FOR T=0 TO 7:POKE7168+Y*8+T,PEEK
(32768+X*8+T):NEXT
```

For example, if you enter the following, hitting the X key will print a ?.

```
FOR T=0 TO 7: POKE 7168+24*8+T,PEEK
(32768+63*8+T):NEXT
```

Design Originals

You're now finally ready to begin designing custom characters. Each one is made of 64 small dots on the screen. It takes eight bytes of memory to store one character, with each byte made up of eight on-off switches called bits. If the bit is turned on, so is the corresponding dot on the screen.

The eight bits within each byte are assigned the following values, which are the powers of 2 up to the seventh power: 128,64,32,16,8,4,2,1. Using (bit on) or not using (bit off) these numbers in all possible combinations gives you all byte values from 0–255. Fig. 1. shows the bit structure of a character resembling the profile of the space shuttle.

The numbers on the right in Fig. 1 represent the values obtained by adding together the values of the individual bits in each byte. To replace the @ with this character, simply Poke the above values into the first eight locations of your RAM character memory.

The standard method for doing this uses data statements as follows:

```
10  READ A:IF A = -1 THEN 100
20  FOR T = 0 TO 7 :READ B : POKE(A*8)+
    7168+T,B: NEXT
30  DATA 0, 0, 0, 128, 192, 254, 255, 0, 0, -1
100 END
```

The first data number is the screen Poke code of the character being replaced. The −1 tells the program that the last character has been entered. If more than one character is entered, the −1 is used only after the last character's data line.

An even easier way to make custom characters is with the programmable character generator. When the program is run, it moves 64 characters into user RAM, pokes in any new characters that have been designed and then stops to let you test the new characters. Entering CONT places the character generator itself on the screen.

0 0 0 0 0 0 0 0 = 0
0 0 0 0 0 0 0 0 = 0
1 0 0 0 0 0 0 0 = 128
1 1 0 0 0 0 0 0 = 192
1 1 1 1 1 1 1 0 = 254
1 1 1 1 1 1 1 1 = 255
0 0 0 0 0 0 0 0 = 0
0 0 0 0 0 0 0 0 = 0

Fig. 1. The bit structure of a character resembling the space shuttle.

The VIC will draw a box with the numbers of the bytes on the sides and the numbers of the bits at the top and bottom. The bits are numbered from seven to zero to show the power of two that represents the value of that bit. For instance, $2^7 = 128$, the value of this highest bit.

Draw your new character by moving the cursor with W = up, X = down, A = left, D = right. Pressing the space bar will place a colored box under the location of the cursor. If an error is made, press F3. This allows you to erase the colored boxes by pressing the space bar. Pressing F1 returns the program to the drawing mode.

When the character is finished, move the cursor below the box and press F5. The program will then print out the Poke values for the new character and ask for the screen Poke code of the character to be replaced. See the user's guide on page 141 of the manual. Remember also that the character set uses only characters from 0–64.

When you enter this number, the program automatically writes a data line for the new character and adds this line to itself. It next returns to the beginning to enter the character into the character set and then stops so you can test the character by typing the key of the character that was replaced.

At this point, never use the return key except to continue the program by entering CONT or GOTO8000. If you do

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not like a character, simply make a new character and re-enter the same screen code as before. Because it will have a higher line number, it will replace the first character.

When you have made all characters desired, enter GOTO9000. This will automatically delete the generator part of the program, leaving only a program for loading the new character set.

You can save this program to tape and load it just like any other. You can add games above line 200, or you can separately load the character set and a game that uses it. All you have to do is draw the characters; the generator does the rest of the work.

If you would like a tape copy of this program, send me a blank tape, a self-addressed stamped envelope and $3, or just send $4.50, and I'll supply the tape. R

```
10 POKE 52,28:POKE56,28:CLR:DIMN(7)
20 FOR T=7168 TO 7679:POKE T,PEEK(T+25600):NEXT
30 POKE36869,255
40 READ A: IF A=-1 THEN200
50 FOR T=0TO7:READ B:POKE7168+A*8+T,B:NEXT
60 GOTO 40
200 DATA-1
7990 STOP
8000 PRINTCHR$(147)CHR$(18)"  76543210  ":REM 2 SPACES
     BEFORE AND AFTER #
8010 FOR T=0TO7: PRINTCHR$(18)T SPC(7)T:NEXT:PRINTCHR$(
     18)"  76543210  "
8020 POKE36869,240:FORT=38400 TO 38632:POKET,6:NEXT:L=7
     704:TH=32
8030 CH=160:LL=7704:PRINT"F1=PRINT F3=ERASE":PRINT"SPAC
     E=MARK F5=ENTER"
8040 POKELL,160:FOR T=1 TO 10:NEXT:POKELL,32
8050 IF PEEK(197)=39 THEN CH=160
8060 IF PEEK(197)=47 THEN CH=32
8070 IF PEEK(197)=17 THEN Y=Y-1:IFY<0 THEN Y=0
8080 IF PEEK(197)=18 THENY=Y+1:IFY>7 THENY=7
8090 IF PEEK(197)=9 THEN X=X-22: IF X<0 THEN X=0
8100 IF PEEK(197)=26 THEN X=X+22:IFX>220 THEN X=220
8110 IF PEEK(197)=32 THEN TH=CH
8120 IF PEEK(197) =55 THEN 8140
8130 POKELL,TH:LL=L+X+Y:TH= PEEK(LL):GOTO8040
8140 PRINT CHR$(19)CHR$(17);:FOR X=0TO7:FOR Y=0TO7:FORT
     =631TO640:POKET,0:NEXT
8150 FORX=0TO7:FORY=0TO7:IF PEEK(7704+X*22+Y)=160THENN(
     X)=N(X)+2[UP ARROW](7-Y)
8160 NEXT Y:PRINT TAB(14)N(X):NEXT X:PRINT:PRINT:PRINT
8170 PRINT"ENTER SCREEN"
8180 INPUT"CODE #";A:IFA<0ORA>64THEN8170
8190 PRINTCHR$(147)CHR$(17)CHR$(17)
8200 Q=Q+1:PRINT60+Q"DATA"A;:FORT=0TO7:PRINT","RIGHT$(S
     TR$(N(T)),LEN(STR$(N(T)))-1);
8210 NEXT:PRINT:PRINT:PRINT"Q="Q":";
8220 PRINT"GOTO20":RESTORE
8230 PRINT"GOTO8000=CONTINUE     GOTO9000=END[HOME]"
8240 POKE198,0:POKE631,13:POKE632,17:POKE633,13:POKE198
     ,3:END
9000 PRINTCHR$(147)CHR$(17)CHR$(17):FORT=7990TO8070STEP
     10:PRINTT:NEXT:PRINT"GOTO9020
9010 FORT=631TO640:POKET,13:POKE198,10:NEXT:PRINTCHR$(1
     9):END
9020 PRINTCHR$(147)CHR$(17)CHR$(17):FORT=8080TO8160STEP
     10:PRINTT:NEXT:PRINT"GOTO9040"
9030 FORT=631TO640:POKET,13:NEXT:PRINTCHR$(19):POKE198,
     10:END
9040 PRINTCHR$(147)CHR$(17)CHR$(17):FORT=8170TO8240STEP
     10:PRINTT:NEXT:PRINT"GOTO9060"
9050 FORT=631TO640:POKET,13:NEXT:PRINTCHR$(19):POKE198,
     10:END
9060 PRINTCHR$(147)CHR$(17)CHR$(17):FORT=9000TO9070STEP
     10:PRINTT:NEXT
9070 FORT=631TO640:POKET,13:NEXT:PRINTCHR$(19):POKE198,
     10:END
```

Listing of VIC-20 programmable character generator program.

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A Cure for the Ailing Doctor's Office

Much of the medical industry, particularly the larger institutions, is becoming computerized. But what about the family physician with a modest practice? Read why the Commodore 64 was just what the doctor ordered.

By George H. Boyd, Jr., M.D.

Address author correspondence to Dr. George H. Boyd, Jr., 321 Nokomis Ave. South, Venice, FL 33595.

In reading the many articles about the introduction of computers into medical practice, it occurs to me that the purveyors of computer systems and programs are ignoring a large segment of the medical profession. Most of their impetus seems directed at large medical groups who can justify the cost of big multi-user systems. Largely overlooked is the solo practitioner with a small or moderate practice, a less impressive gross income and generally modest requirements in an office computer system.

I am a family physician who has practiced in a moderate-sized Florida community for over 23 years. In the course of my work, I've accumulated a roomful of file folders containing patient's charts, clinical records, reports and notes. I have two employees, a registered nurse to help with my patients, and a receptionist-bookkeeper Girl Friday who runs my front office operation. Neither one has had any computer training or experience.

In short, mine is the typical situation of your average solo practitioner with a modest practice, and there are many thousands of them in this country. With my office bogged down by reams of paper and slow manual processes, I decided to computerize.

Commodore: R for Order

My involvement with computers and computing arose in connection with my hobby of 35 years, amateur radio. As I learned more and more about computers and computing, I became convinced that a physician in my situation could not justify the expense of an all-out computer system like those advertised for physician groups. But the urge grew to develop some sort of computer system that would be useful and practical in my office, and in the spring of 1983 I took steps.

I bought myself a Commodore 64, two VIC-1541 floppy disk drives, a monitor and a VIC-1525 dot-matrix printer. While waiting for some delayed hardware to arrive, I bought a copy of the *Commodore 64 Programmer's Reference Guide*, studied it and began writing a series of short programs in Basic to perform useful tasks in my office.

The first such program was designed to print out, by means of subroutines called from a menu, a group of frequently used forms. We continue to keep clinical records on paper, but the chart sheet we use is "headered" with the patient's name, address, date of birth, telephone number and chart number, printed from answers to prompts in the program.

Other subroutines produce forms authorizing doctors or hospitals to release past medical records to me, reminding patients to make appointments for procedures done on a regular basis, permitting patients to return to school or work, or the elderly and infirm to travel by air, and so on.

As my various hardware units were delivered, I followed their manuals' instructions on how to integrate disk and printer commands into my programs. By the time all the hardware was assembled, I had my Short Forms program largely written, and found—to my gratification—that it required only minor formatting to run well.

Headaches and Cures

I did the hardware modification described in the disk drive manual to make Device No. 9 out of my second drive. This simple procedure consisted of cutting one printed circuit foil jumper on the disk drive controller board. A Phillips screwdriver and a sharp pocket knife took care of that operation in a few seconds.

With the units all interconnected and manual in hand, I attempted to put the system through its paces. It bombed! A couple of frantic calls to the Commodore Support Center in Pennsylvania elicited the information, not mentioned at all in the disk drive manual, that the units must be powered-up in a particular sequence.

The computer is turned on first, followed by printer, first disk drive and then second drive, allowing each unit to go through its initialization before applying power to the next unit in the sequence. With this properly done, the hardware worked perfectly.

I continued to write short programs. One of them prints a form for recording my findings on a physical examination; another produces two copies of an immunization schedule for a baby, one for the mother and one for my record. When my nurse gives an immunization, she enters the date and her initials in the appropriate spaces.

As the short programs accumulated, I began to cast about for a method of "chaining" them, so that a control program could call and run other programs. I wrote a short program called Multi to do this, but found it didn't work. More calls to the Commodore Support Center brought word that a control program has to be at least four blocks longer on the disk than any program it calls. There was no mention of this little idiosyncrasy in the manuals, either.

I solved the dilemma by adding Multi as a subroutine in the Short Forms program, and renamed the whole program Control. I had to increase the length of Control by adding a block of remark statements, but it worked like a charm! Now, when my Girl Friday arrives in the morning, she loads and runs Control to get ready for the day's work.

Among the small amount of software I've bought for my system is a disk-based word processor program called The Writer's Assistant, from Rainbow Computer Corporation in Pennsylvania. Written specifically for the C-64, it takes care of our needs quite adequately—and comes with a manual that's a gem of clarity!

On the strength of my success with The Writer's Assistant, I've purchased two other programs that are mates of my word processor. They are The Filing Assistant, a very fine little database program, and The Spread Sheet Assistant, which is self-explanatory.

The database program is the basis for a re-call file for patients who need to be reminded to make appointments for needed examinations. Since most of these procedures are done annually, the system won't bear fruit until next year, but the re-call file is growing.

I had some difficulty in getting a program that would make backup copies of my data-file disks. Some of the copy programs provided by Commodore on the demonstration disk wouldn't copy my files. I eventually secured a program called CMSCOPY, which is slow, but copies my data files perfectly.

The spread sheet program has been a real eye-opener for me. I've only started using it in the last month, but it's providing me with accounting data about my practice that I've never had at my fingertips before. (So much for expensive accountants.) I've thought of a multitude of ways to put this program to work for us, and suspect I've only begun to scratch the surface.

As mentioned earlier, my Girl Friday is not trained in the use of computers. She is a valued employee, and I had to sneak up on her blind side to get her involved in my system. I went at this slowly, writing for her a looseleaf manual that explains in clear and simple terms just how to use the equipment and the programs. She no longer feels timid about using the computer, and, most gratifying to me, is now taking pride in using it.

I've been reluctant to go to the computer with my appointment book. New appointments, cancellations and changes are made constantly through the day, and a patient appointment program would tie up the computer too much of the time. The system's other functions are more urgent.

I'm also considering the addition of a second C-64 within the next few months and am investigating methods of linking the two computers, possibly with some shared peripheral use. Eventually, I also want to add a modem to get some telecomputing capability, for medical databases seem to be growing in number and variety.

In summary, for a very modest outlay of cash and a considerable investment of time and effort, I have a simple, eminently practical office computer system in development. What it may lack in sophistication is certainly balanced by a great deal of utility. Ⓡ

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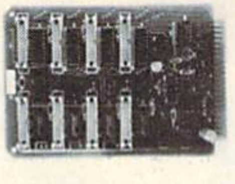

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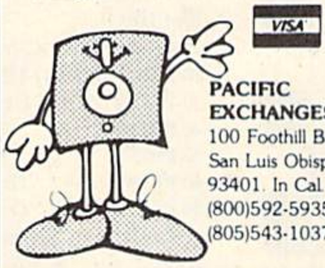

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A Basic Excursion
Beyond the Manual

By Jeffrey Mills

With this installment of the Basic programming series under your belt, you'll be well on your way to becoming a full-fledged, certified programmer. This month, you'll discover how to assign values to variables—a trick that simply every programmer must have in his repertoire.

Last month, in Part One of this series, we started to develop a program that will catalog all of your programs and list them by tape number.

We discussed the housekeeping commands New, CLR and List. We also discussed REM and line numbering. So far our program looks like this:

```
10 REM *** PROGRAM/TAPE CATALOG ***
20 REM *** WRITTEN BY: your name **
30 PRINT " [Shift-CLR/HOME] "
40 PRINT "          TAPE CATALOG"
50 PRINT
60 PRINT "101","GAME 1"
70 PRINT "101","GAME 2"
```

Let's now go back and add column headings to our list. We'll use the Print statement with commas. Type:

```
52 PRINT "TAPE","PROGRAM"
54 PRINT "NO.","NAME"
56 PRINT
```

Notice how we inserted lines between existing line numbers. This is a good example of why you need to number by tens when you start out.

As we ended last month, you may have been thinking, "There has got to be an easier way than using a separate Print statement for each program in the list." There is! Before we get too far into that discussion, however, there are a couple of things you'll need to know.

More Terminology

1) *Variable*—A variable is a small portion of the computer's memory, to which is assigned a value or other content that may change, or vary, in the course of a program. You might think of variables as little boxes or file drawers created in memory by a program statement.

There are several types of variables. For our present purposes, we'll discuss only numeric and string (letter or character) variables.

You can call a variable in your program by any name you please, within the following rules:

- It *must* begin with a letter of the alphabet (A–Z), but you may use either a letter or a number (0–9) in the second position of the name.
- The first two letters of the name must be different from the first two of any other name you choose. These two letters are the ones the computer uses to tell one file drawer from another. For example, the computer will think that BOY and BOAT are the same, because it will only look at the first two letters.
- You may not use any variable name that begins with the same two letters as any Basic Keyword. (See appendix D of your manual.)

If the variable is to contain only numbers, you use a numeric variable. If it is to contain characters (letters and symbols), you use a string variable.

The rules for variable names are the same for numeric and string variables. The way you tell the computer that the variable will contain letters and symbols is by adding a dollar sign ($) to the end of the name.

It is usually best to keep variable names as short as possible, because each character takes up space in the computer's memory. However, if you call a variable that stores a name NAME$, it will be easy to look back at the program some time in the future and know what that variable represents.

Address author correspondence to Jeffrey A. Mills, PO Box 06021, Columbus, OH 43206.

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2) *Assignment statement*—Now that you know that the computer can store information in file drawers called variables, how do you get the values into those variables? You do this with an Assignment statement.

Say you call a variable "A" and want it to assume the value 5. Just typing A = 5 is sufficient. (You can also type LET A = 5, but the Let command is seldom used, since the Commodore will assume you mean Let if you just type A = some value X.)

If you want to change the value in variable A to something else, say 12, simply typing A = 12 will eradicate the 5 and put 12 into file drawer A in its place.

Reading the Data

3) *Read/Data*—The use of the two commands Read and Data makes it easy for you to assign values to variables. You may remember having read about these two Basic statements on pages 92 through 94 of your manual.

The Data statement is non-executable. It is not a verb. The computer does not do anything when it sees this word in a program.

A Data statement simply stores numbers and words that you want the program to use. They are listed in the order in which they are to be used, and are separated by commas. Unlike the Print statement, these commas have no effect on the output of the items in the Data statement. They simply identify the separation between two pieces of data.

When you Run a program, the computer takes all the items in Data statements and stores them in a special location. It can then retrieve the items whenever your program calls for them. The way you tell the computer to get an item from a Data statement is with the Read command.

The Read command takes the next value in the list, places it into the variable you specify and moves a pointer to the next item in the list. The pointer tells the next Read statement where to begin.

In general, once an item is read, it is not accessed again. (In a future article, you will discover a way around this.) The Read command moves through the list item by item until it runs out of items to read. (If you try to read more items than are in the Data statement list, your program will terminate with an Out of Data error.)

A typical Data statement looks like this:

```
90 DATA 2,42,56,13
```

A typical Read statement looks like this:

```
100 READ A
```

By using the Read command, you are telling the computer to read the next item from its list of Data statements and put what it reads into the variable specified in the Read statement.

When the line above is executed, A will contain the number 2. If the next line were 110 READ B, the variable B would contain the value 42, and A would still contain the value 2.

You can also put string data into Data statements. For example:

```
90 DATA CAT, DOG, BIRD
```

Now your Read statement will have to specify a string variable. For example:

```
100 READ A$
```

When this statement is executed, the variable called A$ (pronounced A-string) will contain the word cat. If line 110 were now changed to 110 READ B$, B$ would contain the word dog, and A$ would still have its feline inhabitant.

You can also mix numeric data and string data (numbers and words) in one Data statement. For example:

```
90 DATA 1,GAME 1,1,GAME 2
```

Now the Read statements would be as follows:

```
100 READ A
110 READ A$
120 READ B
130 READ B$
```

After these statements are executed, A will contain the value 1, A$ the string of characters GAME 1, B the value 1 and B$ the string of characters GAME 2.

Just as you use commas to separate the items in the Data statement, you can specify that more than one item be read in one Read statement. For example:

```
100 READ A, A$, B, B$
```

This statement will achieve the same outcome that was produced with the four lines above.

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Back to Our Program...

Since you can now assign values to variables, you'll be able to print your listing with only one Print statement (after the headings). However, there is one more concept we need to touch upon, so you can accomplish your task efficiently. This is the GOTO loop, which will be covered more fully in a later article.

For now, just remember that the GOTO statement will tell your computer to go to a given line number within the program. By telling it to do that at the end of a series of lines, you can cause the computer to perform the same set of instructions over and over until something changes to cause it to stop. (GOTO is explained on pages 32 and 33 of your manual.)

Let's replace lines 60 and 70 in our Catalog program with a Read statement and a Print statement. Type these lines:

```
60 READ N, P$
70 PRINT N, P$
```

As you may have guessed, we will also need a Data statement to go along with the Read statement. To keep things simpler, we will give the Data statements line numbers that are high enough to allow us to put other lines before them. Let's start with line number 9000. Type:

```
9000 DATA 101, GAME 1, 101, GAME 2
9010 DATA 102, GAME 3, 102, GAME 4
9020 DATA 103, GAME 5, 103, GAME 6
```

The items in each of these statements are a tape number, game name, tape number and game name. Running the program now will only Print the first tape number and the first game name. This is where the GOTO loop comes into play.

```
        TAPE CATALOG

   TAPE   PROGRAM
   NO.    NAME

     1    GAME 1
     1    GAME 2
     2    GAME 3
     2    GAME 4
     3    GAME 5
     3    GAME 6

?OUT OF DATA ERROR IN 60
```

Example 1. Screen display of Catalog program.

Typing 80 GOTO 60 will cause our program to enter a loop. It will perform lines 60 and 70, but when it performs 80, it will go back to 60. It will then perform 60 and 70 again...and again...and again...

When the program has read everything that is in the Data statement list, the program will end by printing on the screen:

```
?OUT OF DATA  ERROR IN 60
```

There is a list of all of the Commodore's error messages on pages 150 and 151 of the manual. Don't be surprised if most of them don't mean much to you right now. We'll probably run across most of them on our screen as we experiment with writing Basic programs.

Example 1 shows the output of the Catalog program as we have developed it thus far.

In the next article I'll discuss ways to prevent the program from ending in an error, as well as ways to control program looping within the GOTO loop. R

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RUN Amok

We'd like to be perfect. Who wouldn't? Alas, however, we are not. The glitch-gremlins play naughty tricks, or we human beings just have lapses of consciousness at the wrong moments.

In any case, mistakes get made, and on the assumption that eagle-eyed readers or frustrated typers-in will not hesitate to let us know their findings, we will RUN Amok to correct our errors in each issue.

Our apologies to anyone who was inconvenienced or annoyed by one or more of the following in the January issue:

Item: The Script-64 word processing system is a product of Blue Sky Software (Ashland Office Center, Evesham and Alpha Avenues, Voorhees, NJ 08043). It was incorrectly attributed to another company.

Item: In Double Your Pleasure with Conversion Magic, the screen color locations for the VIC as given in Table 1 (p. 83) are incorrect. They should read 38400–38905. In the same article, line 3140 in Listing 2 is missing a portion. It should read: 3140 X=A1: POKEFNCL(0)+30720,5: POKEFNCL(0),L1: FORX=A1+1TOA2−1: POKEFNCL(0)+30720,5

Item: A minor goof, but we nonetheless regret the tantalizing "More" that appears, but should not, at the end of the Canyons of Zelaz program listing on p. 52. There really is no more after line 1018.

Item: In Fun with Math Facts, line 1000 in Listing 1 (p. 37) was missing a colon. See Listing 1 for correction.

Item: Some lines were inadvertently omitted from the listing of the Sea Battle program. They appear below, with the VIC-20 version first (p. 134) and then the C-64 omission, the final line of the program, on p. 136.

```
610 GOSUB790:IFPEEK(FX)=0THENEF=FX:GOSUB830:GOTO670
620 IFPEEK(FX)=35THENPOKEFX+W,2:EF=FX:GOSUB830:POKEFX,4
     2:FH=FH+1
630 IFFH<>17THEN660
640 PRINT" I WIN!!"
645 FORI=7912TO8185:IFPEEK(I)>57ANDPEEK(I)<63THENPOKEI+
     W,3:POKEI,35
650 NEXT:FORT=1TO5000:NEXT:GOTO720
660 NEXTZ:GOTO450
670 POKEFX,42:NEXTZ:GOTO450
680 POKEEF+W,2:GOSUB830:POKEEF,42
685 PRINT"HIT "S$(Q):EH=EH+1:SS=2:GOSUB810:GOSUB780
690 IFHI=HSTHENPRINT"SANK "S$(Q):SS=4:GOSUB810:GOSUB780

700 RETURN
710 PRINT"YOU WIN!!":SS=8:GOSUB810
720 FORT=1TO2000:NEXT:PRINTCHR$(147):PRINT" PLAY AGAIN?
      (Y/N)"
730 GETPA$:IFPA$=""THEN730
740 IFPA$="Y"THENCLR:GOTO90
750 END
760 FORI=7680TO7810:POKEI,32:NEXT:RETURN
770 PRINT"BAD COORDINATE. START OVER.":FORT=1TO2500:NEX
     T:CLR:GOTO90
780 FORT=1TO1500:NEXT:GOSUB760:RETURN
790 POKES2,200:FORT=15TO0STEP-.1:POKEV,T:NEXT:POKES2,0:
     RETURN
800 FORG=1TO10:FORH=1TO10:POKEEC+EB,0:EB=EB+1:NEXT:EC=E
     C+22:EB=0:NEXT:GOTO380
810 POKEV,15:FORI=1TOSS:FORJ=1TO10
815 POKES1,230:FORT=1TO10:NEXT:POKES1,235:FORT=1TO10:NE
     XT
820 NEXT: POKES1,0:FORT=1TO50:NEXT:NEXT:RETURN
```

Lines missing from the Sea Battle VIC-20 program.

```
860 FORJ=WTOW+23:POKEJ,0:NEXT:RETURN
```

Line missing from the Sea Battle C-64 program.

```
1000 PRINT"[SHFT CLR]":PRINT"LEVEL OF DIFFICULTY?":PRIN
      T"1,2,OR 3;":PRINT"(1 IS EASIER)":PRINT"CHOICE?"
```

Listing 1. Fun with Math Facts correction.

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Compiled by Shawn Laflamme

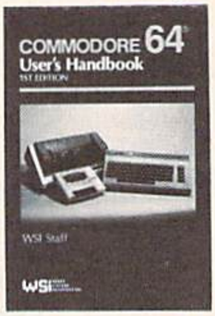
Commodore 64 User's Handbook

WSI Staff
Weber Systems, Inc.
8437 Mayfield Road
Cleveland, OH 44026
Softcover, 307 pp., $14.95

The *Commodore 64 User's Handbook* is a concise introduction to the computing, graphics and sound-generating capabilities of the Commodore 64. It was written with the new C-64 owner in mind.

If you have no previous computer experience, you will appreciate the simple style used by the authors. Readers who anticipate the purchase of a personal computer will find the book to be a useful, well-organized preview to the features of the Commodore 64.

The book is divided into eight chapters and concludes with eight appendices and an index. Chapter 1 introduces the reader to the physical features of the C-64. A brief description of each feature and accompanying illustrations help you to identify the various parts of the computer. Also introduced are C-64 peripherals and some important computer terms.



In Chapter 2, you will find instructions on how to set up your Commodore 64. The keyboard is described, and the use of various keys is explained. You will also find instructions for the setup and use of the Datassette cassette recorder, the Commodore 1541 disk drive and Commodore printers.

One of this chapter's best features is a brief table listing three hardware-related problems that are commonly encountered by new users. For each problem, some possible causes are listed, and solutions to the problem are suggested.

A tutorial on programming the Commodore 64 in Basic is presented in Chapter 3. Basic commands, statements, functions and variables are introduced in a logical sequence. In most cases, brief examples are given to illustrate the use of the Basic reserved words.

Chapter 4 is a Basic reference guide for the C-64. The Basic reserved words are listed in alphabetical order for easy access, and the proper syntax to be used with each word is given. Examples are used to illustrate the use of each word, and some additional detail is given on the function of most of the keywords.

Chapter 5 discusses the Commodore Datassette cassette recorder; the creation and use of cassette data files is covered. The Commodore 1541 disk drive, disks, disk files and DOS commands are discussed in Chapter 6; the three types of disk files (sequential, random and relative) are covered in detail.

Chapter 7 is devoted to Commodore 64 printer operations, beginning with installation of the printer and concluding with a detailed discussion of the Commodore 1525 printer control codes.

The last chapter is a discussion of sound and graphics, with sections including: display and text colors; display, character and color memory locations; custom characters; high resolution graphics; sprite graphics; and sound features. Each section is succinct, but the text is supplemented with tables, illustrations and brief examples.

Some important information about the Commodore 64 has been gathered into the eight appendices, including: Basic error messages; codes and characters associated with the CHR$ and ASC functions; screen codes used with the two standard character sets; Basic reserved words and their keyboard abbreviations; values to be Poked into the frequency registers of the sound chip; a memory map; and a list of Basic keyword one-character tokens.

I enjoyed reading the *Commodore 64 User's Handbook*. The language is clear, and the topics are presented in a logical order. A few things were explained more clearly than in other user's manuals that I have used. I especially liked the treatment of Commodore 64 memory locations in the appendices.

Here's a book written with the new C-64 owner in mind.

On the other hand, some readers may find the Weber Systems staff's concise style of writing a bit dry. While the authors use numerous examples throughout the book, their treatment of several topics was much too brief.

I was particularly disappointed with the discussion of sound in Chapter 8. The basic sound features are discussed, but there is no mention of the use of sound filters. The fact that the values to be Poked into the frequency registers of the sound chip may be calculated (thus freeing the user from the musical note tables found in appendix E) is not mentioned. Nor is there enough discussion of how the waveforms or attack, decay, sustain and release parameters affect the quality of the sound produced.

The coverage of graphics and a few of the sections on Basic could have

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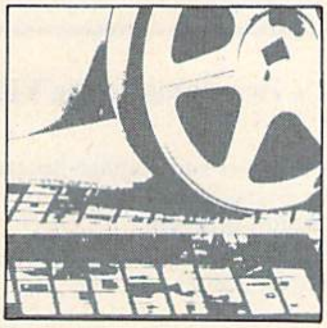

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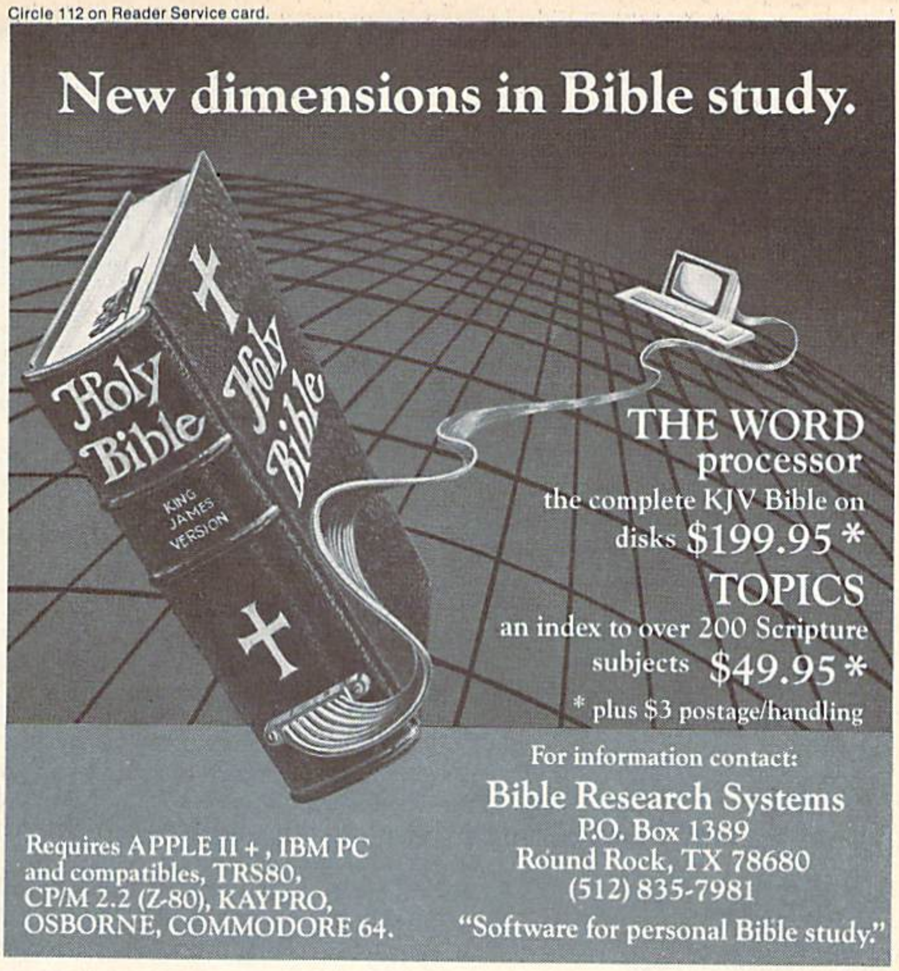

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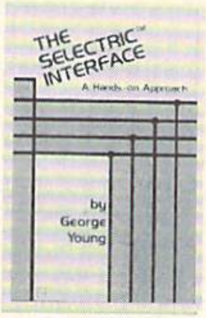

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been expanded. One important feature of the C-64 which does not seem to be mentioned anywhere is the Commodore 64 screen editor. However, the book does have a brief section on correcting keyboard errors.

I'd recommend this book to a new Commodore 64 owner. If you have no previous experience with computers, you will appreciate the care that was taken in preparing the sections on the installation of the computer and peripheral devices.

On the other hand, I wouldn't recommend the book to you if you're an intermediate or experienced user. You may find the chapters on printers and disk drives useful if you're about to purchase those peripherals, but, as a whole, you would probably be better served by another manual.

David Scott Saari
Elkhart, IN

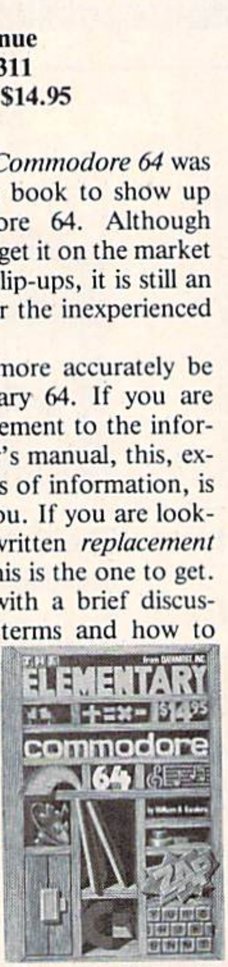
The Elementary Commodore 64

William Sanders
Datamost, Inc.
8943 Fullbright Avenue
Chatsworth, CA 91311
Softcover, 223 pp., $14.95

The Elementary Commodore 64 was the first third-party book to show up for the Commodore 64. Although some of the rush to get it on the market is evident in a few slip-ups, it is still an excellent volume for the inexperienced programmer.

The title might more accurately be The *Very* Elementary 64. If you are looking for a supplement to the information in your user's manual, this, excepting a few points of information, is not the book for you. If you are looking for a clearly written *replacement* for your manual, this is the one to get.

Sanders begins with a brief discussion of computer terms and how to hook up your system. His chapters covering programming techniques are logically presented, and hardly a page goes by without a sample program illustrating the technique in question. At almost every point, you will be wishing he had said more on the subject, but it is, after all, meant to be an introductory book.



> *Despite a few slip-ups, this is an excellent volume for the inexperienced programmer.*

The chapter on data and sequential files will clear up a major mystery for many beginners. This subject is barely touched upon in the user's manual, and only in reference to cassette storage. Disk users are ignored in the manual, and even "Commodore's Reference Guide" refers them to the disk drive manual, which assumes a certain familiarity with the technique. Sanders clearly explains the basics of files for both storage systems.

One indication of the hurry involved in getting this volume together is the absence of an Appendix A referred to in the text. There may be other appendices missing as well; none are listed in the table of contents.

A larger problem that resulted from getting this book out so soon is that it does not take into account a revision made to the C-64 shortly after its release. The information in the chapter on Poking to the display file just won't work on the revised C-64. That model has to have both its screen memory and color memory Poked before anything will appear on the display.

The first C-64s had the color memory automatically filled with white, and the third version fills color memory with the cursor color. Second versions, however, currently make up the bulk of the market, and a lot of users unaware of the problem will be throwing down this volume in anger, disgust and frustration when the tutorial programs don't work on their machines.

While there's no denying that the screen Poke problem is a major flaw, the book is an otherwise well-written, well-rounded volume that includes chapters on tape, disk and printer use, and explanations of types of software, such as database and utility programs.

Sanders is working on a series of elementary books for various home systems. This one is good enough that we should hope he comes back to the C-64 to write intermediate and advanced volumes.

Sharon Aker
Sussex, NJ

User's Handbook to the VIC-20

Jeffrey Weber and Stephen Szczecinski
Weber Systems, Inc.
8437 Mayfield Road
Cleveland, OH 44026
Softcover, 278 pp., $13.95

It wasn't so long ago when there were no books on how to program the VIC-20, but fortunately things are changing. A case in point is the *User's Handbook to the VIC-20.*

The book begins with a general discussion of the VIC-20 system, along with a description of the various peripherals such as disk drives, Datassettes and printers. Further extensions including memory expanders, IEEE-488 cartridges and motherboards are touched upon, but the emphasis here is to briefly survey what's available for the VIC-20.

User's Handbook to the
VIC-20
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Chapter two gives clear and simple instructions for installing and interconnecting the various units comprising the complete system. If you're a new VIC-20 user, this will be of great value to you, especially since the authors are very careful to talk about things which many people would consider "too obvious" for discussion.

For example, the notion of error messages and where they come from, how the write-protect tabs work on a cassette tape and the basics of handling floppy disks are treated. Every VIC beginner should be familiar with these subjects.

The first two chapters essentially form an overview and introduction to the book. Chapters three and four get down to the real meat of the subject with over 100 pages devoted to programming in Basic. Each command and statement is described, supplemented with samples of correct syntax and notes on any quirks to avoid.

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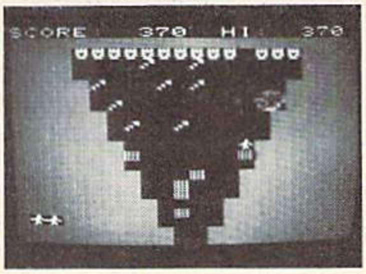

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Chapters five, six and seven describe the use of the Datassette cassette unit, 1541 disk drive and 1525 printer. Each of these chapters goes into great detail and shows how to use these peripherals to greatest advantage. The last chapter gives a very brief treatment of sound and graphics.

It's obvious that no book can treat every feature of the VIC in detail; some topics will be examined thoroughly at the expense of others. It is this picking and choosing of topics which establishes the slant of the book, and this usually depends upon the author's area of expertise.

The chief feature of interest in *The User's Handbook to the VIC-20* is the thorough discussion of how to use the I/O-type peripherals (i.e., the Datassette, disk drive and printer). The chapter on the 1541 disk drive is the best I have seen.

Unlike a number of other books on the market which simply rehash material from the 1541 disk drive owner's manual, this book carefully organizes and details everything you would ever want to know about sequential, random and relative files on a disk drive.

This information will be invaluable to you if you're involved in systems programming, or if you have business and home finance applications in mind. Weber and Szczecinski take an hierarchical approach; starting with general concepts they lead you to a more and more detailed appreciation of the relative value of the numerous DOS commands. It's very hard to get lost with this sort of approach.

Another good feature of the book is the clear description of Boolean concepts in Basic programming. Most books mention logical operators such as And, Or and Exclusive-or, but this book really shows how they work and how to use them to advantage in Basic programs. I was impressed with the descriptions of these concepts; a novice who's afraid of this subject could do no better than to read these chapters.

As mentioned earlier, if some subjects are treated in detail, then it stands to reason that others will get short shrift. In this book, the topics of graphics and sound are barely touched upon; you will find very little beyond what is given in the VIC-20 owner's manual. And in terms of peripherals, it is notable that modems, joysticks and paddles aren't even mentioned.

The emphasis in this book is on Basic programming; nothing is said about the user port and the VIA, since this would assume a background in machine language on the reader's part. Although there is a memory map of the VIC-20 given in the appendix, no real mention of machine language is made throughout the book.

This book's real strength is its treatment of programming the 1541 disk drive.

This book's real strength is its unequalled treatment of how to program the 1541 disk drive. The chapters on VIC-20 peripherals and Basic programming are also worthwhile.

The chief deficiency is the lack of material on high-resolution graphics, sound and (more surprisingly) the joystick and paddles. However, the main thrust of the book seems to be how to program the VIC-20 to handle "serious" things, such as databases, business programs, scientific applications and so on.

The authors have maintained a clear, readable reference book style. (I read the entire book in two sittings.) The material is well-organized with plenty of headings and sub-headings to guide you from general notions to particular concepts. Thus, besides being pleasant to read, the *User's Handbook to the VIC-20* will serve as a good reference text.

To those of you who have done battle with ugly printouts containing reverse field characters, you'll be glad to know that this book is very nicely typeset with clear representations of the special characters. In addition, many photographs are scattered throughout the book, giving it a fine visual quality. The text also seems to be free of typos and other errors which often trouble first edition programming books.

I enjoyed reading this book. While I was already familiar with most of the material on programming in Basic and using the Datassette, I confess that it taught me many new things about the 1541 disk drive. This being the case, I plan on keeping my copy by the computer at all times for quick reference.

Thomas Henry
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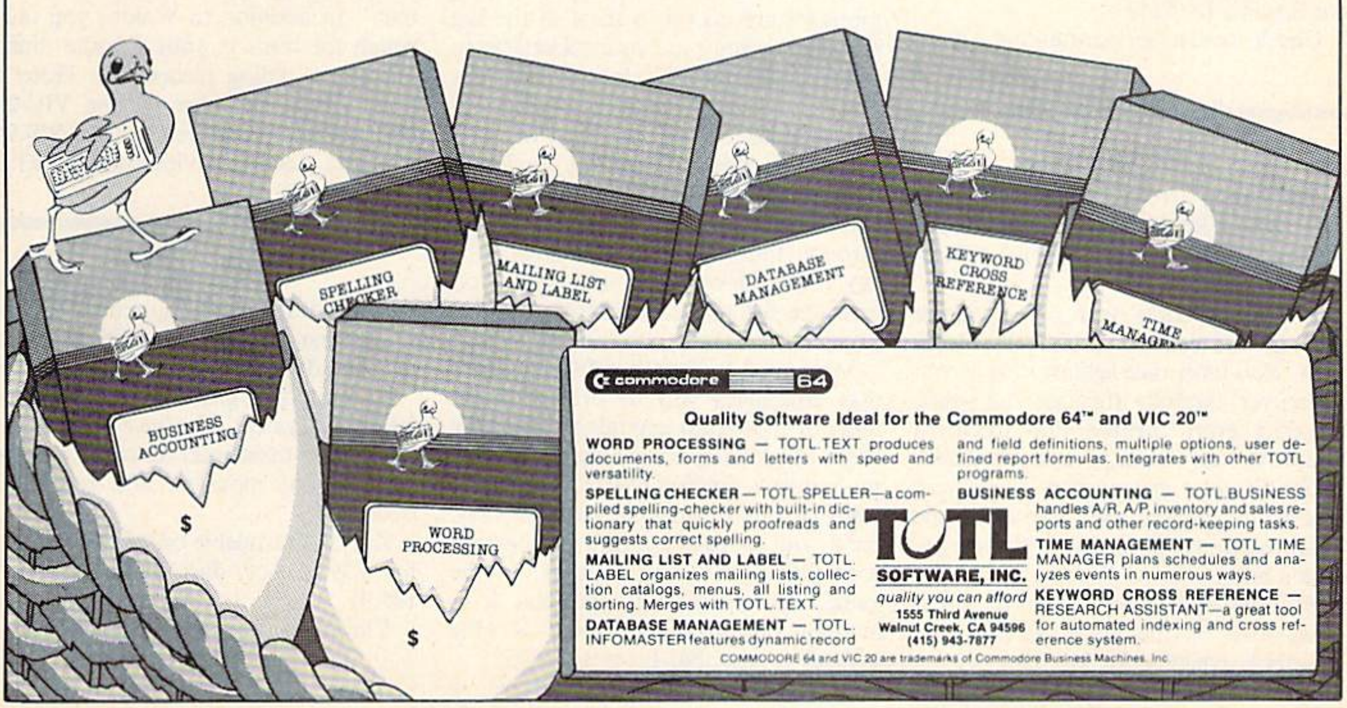

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GamesRUNdown

Compiled by Shawn Laflamme

Quest of the Eagle

Quest of the Eagle, for the Commodore 64, puts you in command of the futuristic starship Eagle. You must seek planets and secure certain elements from them. You must then deliver these elements to other planets as specified by mission control. Your equipment on the Eagle includes radar, map, view, weapons, sensor, scanner, shields, radio, computer and transport room.

During your flight, you will encounter other spacecraft. Some may be friendly and help you with information; others may be hostile and attempt to destroy you. Each voyage is composed of nine missions selected from countless missions. Each of the nine missions becomes more difficult than the last.

Quest of the Eagle features a pause button that allows you to suspend a game in progress. It is available on disk or cassette for $28.75 from Ferin Enterprises, 6310 Underwood Ave. SW, Cedar Rapids, IA 52404.

Check Reader Service number 420.

Vein Voyage

Plasmania, from Sirius Software, Inc. (10364 Rockingham Drive, Sacramento, CA 95827) is available on cassette for the VIC-20.

Plasmania takes you on a voyage through the veins of a critically ill patient. You must race against time as you maneuver carefully through the veins, avoiding every menace that threatens your mission. Defense cells, bacteria, antibodies and enzymes try to prevent you from finding and destroying the life-threatening blood clot near the patient's brain.

Bumper Bash, a video pinball game, is included on the same cassette. The cassette is available for $19.95.

Check Reader Service number 425.

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SAVE NEW YORK
Joystick controller required.
CREATIVE SOFTWARE PRESENTS
A GAME ON CARTRIDGE FOR THE COMMODORE 64™
MOONDUST.
Joystick controller required.

Three New Challenges

Creative Software (230 East Caribbean Drive, Sunnyvale, CA 94089) has released three new games for Commodore owners—Save New York!, Moondust and Rat Hotel.

In Save New York!, city-munching monsters are making a meal of the Big Apple. You must use your rocketship to shoot them down. The hungry creatures also lay eggs that hatch into baby mutants—these infants crawl into the subways and "teethe" on the buildings from the ground up. To destroy them, you must track them down on foot through the sewer system beneath the city. Save New York! is available on cartridge for the Commodore 64. One joystick is required. It costs $34.95.

Moondust is a science-fantasy game that challenges you to draw colorful trails of moondust crystals through the heart of glowing concentric circles. As moondust is dragged toward the center, trails of aqua, emerald green, cobalt, coral and purple appear. The action produces music which reacts to the game play in musical patterns. It is available on cartridge for the C-64. One joystick is required. It costs $39.95.

In Rat Hotel, you are Ermine, a cheese-seeking inhabitant of the Hotel Paradisio. Waldo, the maintenance man, is in hot pursuit. If you can maneuver yourself from the attic, down six floors and into the basement, you will be rewarded with "Le Grand Cheeseball." In addition to Waldo, you must watch for traps in your favorite dining spots and hiding places. Rat Hotel is available on cartridge for the VIC-20. One joystick is required. It costs $39.95.

Check Reader Service number 423.

Zorlok

Micro Information Systems (PO Box 73, Wayne, NJ 07470) has released Zorlok, an adventure game for the VIC-20.

As the great, great grandson of Zorlok the wizard, you have inherited a quest. You must enter his castle, destroy a plague of monsters and regain his treasures.

Zorlok is available on tape (13K VIC) for $39.95, or disk (21K VIC) for $45.95.

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APROPOS TECHNOLOGY

Journey into a Kingdom Of Magical Powers

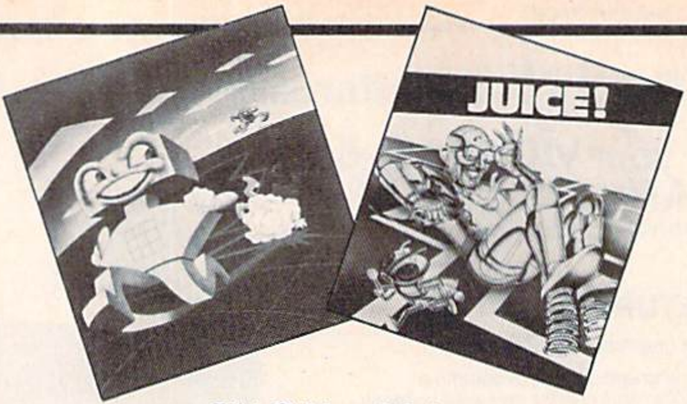
Enchanter, from Infocom, Inc. (55 Wheeler St., Cambridge, MA 02138) is a fantasy game that takes you into a kingdom of magical powers and perilous predicaments.

You must use skill and logic to overcome "Krill," the evil warlock whose ever-increasing powers have shattered the peace of this fantasy kingdom. Sent by the Circle of Enchanters to conquer evil, you will uncover spell scrolls which you must learn to use judiciously in overcoming dozens of tricky obstacles. If you are able to use these magical powers effectively, the evil warlock will be banished forever.

The game package includes a folder containing everything you need to begin your journey. There is a user's manual in the form of a medieval guild directory and a sealed parchment from the Circle of Enchanters.

Enchanter is available on disk for the Commodore 64. It costs $49.95.

Check Reader Service number 421.



Kid Grid and Juice

Tronix Publishing, Inc. (8295 S. La Cienega Blvd., Inglewood, CA 90301) has released Kid Grid and Juice for the Commodore 64.

In Kid Grid, the Kid's goal is to dart around his grid, filling in all the squares. Out to stop him are four bullies: Squashface, Thuggy, Muggy and Moose. The Kid also has to be on the lookout for a mysterious bouncing question mark. You can zap the bullies with your joystick button; as they turn white and vaporize, the Kid makes his escape.

Juice is a strategy game in which Edison must jump from square to square to complete his circuit board. Troublesome Killerwatts and other enemies are out to undo his work. Edison can outthink his enemies, but if he is struck, he melts down. You score points by maneuvering Edison in completing a circuit.

Both games are available on disk for $34.95 each.

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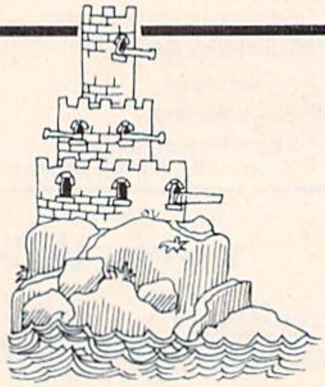

Conquer a Fortress

In Beach-head, from Access Software, Inc. (925 East 900 South, Salt Lake City, UT 84105), you are challenged to conquer a fortress on an island stronghold.

The fortress, circa World War II, is located on an island which has been taken over by a ruthless dictator. The island is protected by a tremendous arsenal—strong air and sea power, heavy artillery and tough land forces.

As Chief Commander of your own land and sea forces, you must maneuver your naval fleet through hidden passages, overcome great air and sea attacks and finally land your amphibious tanks on the beach. In a fight between good and evil, you must thread your way through the island's defense system and force a final confrontation with the fortress.

Beach-head is available on tape or disk for the Commodore 64. It costs $34.95.

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OBNAC (Objective Based Navigation and Attack Computer) helps you track down and destroy enemy ships. A keyboard overlay is included to transform the computer into the OBNAC control console.

Star Battle has ten skill levels. It is available on disk for $24.95 from Timeworks, Inc., 405 Lake Cook Road, PO Box 321, Deerfield, IL 60015.

Check Reader Service number 419.

They're Everywhere!

In Killerpiller, from Castle Software, Inc. (PO Box 350, New Castle, DE 19720), you are a pestered pest eradicator waging war against hungry caterpillars that are out to devour your orchard.

The Killerpillers grow at an alarming rate as they eat your trees. You must fight back with your lethal spray. The Killerpillers lay eggs that hatch into two kinds of moths—normal and mutant. The moths protect the munching Killerpillers from your spray.

The Commodore 64 version is available at the special introductory prices of $9.99 on cassette and $12.75 on disk. A VIC-20 version is available on cassette for $15.99.

Check Reader Service number 418.

Speed Racer and Candy Bandit

T & F Software (10902 Riverside Drive, North Hollywood, CA 91602) has released Speed Racer and Candy Bandit for the Commodore 64.

Speed Racer puts you behind the wheel of a speeding car on a busy city street. You have the option of acting as an angel or a devil—you can score "heavenly" points by avoiding the pedestrians, or "devilish" points by running over everything in sight. You control your speed and steering with your joystick.

In Candy Bandit, you are a sweet-toothed candy thief intent on stealing as much candy as possible while being chased by a sheriff. Besides eluding the sheriff, you must avoid hitting the walls, or you'll stick to them. There are 11 difficulty levels—you must search for rotating doorways to advance to the more challenging levels.

Speed Racer and Candy Bandit are available on disk or cassette for $29.95 each.

Check Reader Service number 422.

SEAFOX
Brøderbund Software

Slyness at Sea

Seafox, from Brøderbund Software (17 Paul Drive, San Rafael, CA 94903) is available for the VIC-20.

In Seafox, you are the captain of a submarine. Your mission is to wipe out a convoy of enemy ships and their escorts. You will need superior maneuvering ability and fortitude to dodge exploding depth charges, mines and torpedoes. Keep a sharp watch for your surprise ally—he'll help you survive.

Seafox is available on cartridge for $34.95.

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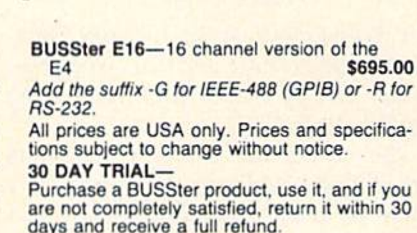

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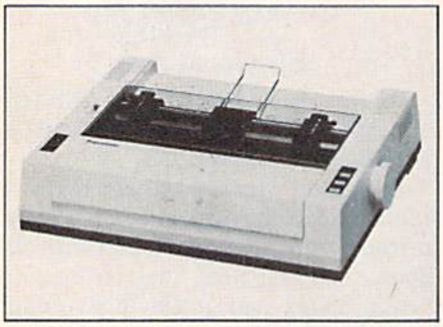
Hardware RUNdown

Compiled by Shawn Laflamme



Panasonic Printers

Panasonic Industrial Company (One Panasonic Way, Secaucus, NJ 07094) has released two dot matrix impact printers featuring high-speed printing and graph capabilities. Both printers are compatible with the Commodore 64 and the VIC-20.

The Model KX-P1160 is a bidirectional printer capable of handling fanfold paper from four to 15 inches wide. An optional front inserter is available to print single sheets. It costs $1750.

The Model KX-P1090 is a bidirectional printer that can accommodate an 8.5 inch roll of paper or fanfold and letter paper from four to ten inches wide. It costs $499.

Check Reader Service number 433.

Take Cover

Tailored cloth covers for your Commodore printer are available from Discovery Design Center (PO Box 72289, Roselle, IL 60172).

The covers are available in colors and fabrics designed to match any home or small office decor. You can select from three alternatives—tan duck with navy blue trim, blue denim with white trim or chestnut suedecloth trimmed with chocolate brown.

The all-cloth covers won't create static electricity. They cost $12.50 each.

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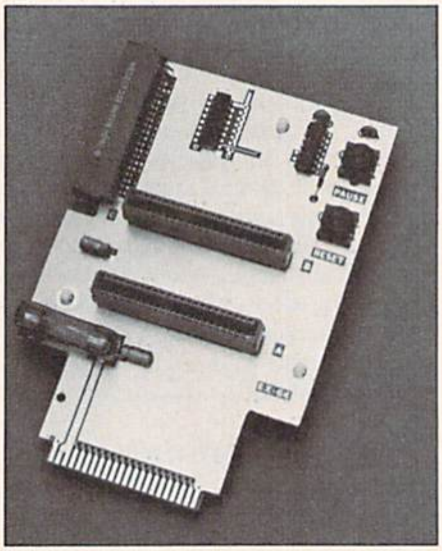

Expansion Interface Board

The Micro-X64 is an expansion interface board for the Commodore 64. It works with a combination of different peripherals and programs.

The board has three expansion slots. Two of these are in a vertical position and are used with programs on cartridge. The third slot is on the left side of the board and has a horizontal orientation.

The Micro-X64 also features a pause switch that can halt a program or machine function and start it again at the same point. The "nondestructive" reset button can restart the C-64 at any point and will not interfere with machine-language programming in memory.

The Micro-X64 is available for $49.95 from Compuscope, Inc., 6400 Signal Road, Tillamook, OR 97141.

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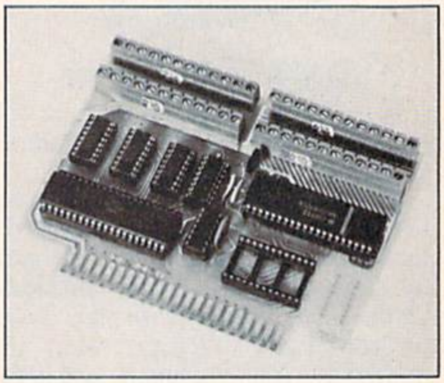

Input/Output Boards

Micro World Electronix (3333 S. Wadsworth Blvd. #C105, Lakewood, CO 80227) has released universal input/output boards for the Commodore 64 and the VIC-20.

Each board features a 16 channel 8-bit converter with 100 μs sampling time, a D/A output, 16 high voltage/high current discrete outputs and one EROM socket. Up to six multiple boards may be used to provide additional channels. The boards are useful in university physics labs, electrical engineering labs and hospitals.

The MW-311V, for the VIC-20, costs $205. The MW-311C, for the C-64, costs $225.

Check Reader Service number 438.

Software News

The Soft-Guide Newsletter consists entirely of software reviews for the VIC-20 and the Commodore 64. In each issue, you will find information about the available software for your micro without wading through information about other systems.

The newsletter is available to subscribers for $19.95 for twelve monthly issues. It is published by J.H. Wheeler Co., 4974 N. Fresno St., Suite 303, Fresno, CA 93726.

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Temple of Apshai C/D	39.95	28.30
Turtle Graphics R	39.95	27.60
VIC Music Composer R	39.95	28.30
Wordcraft 20 R	99.95	69.05

SUPPLIES/EQUIPMENT	LIST	SALE
Cardco Cassette Interface	$39.95	$32.60
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Cardco Light Pen	29.95	24.45
Elephant Disks SS/DD (10)	37.00	24.35
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Epson MX-80 Ribbon 2-pac	28.00	12.55
Flip-N-File (Disks)	29.95	18.85
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Maxell MD1 Disks (10 pack)	51.90	29.40
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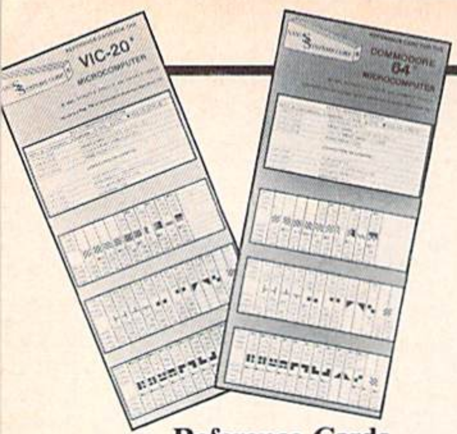

Reference Cards

Nanos System Reference Cards (Nanos Systems Corp., PO Box 24344 Speedway, IN 46224) are available for the Commodore 64 and the VIC-20.

The accordion-style cards of 16 panels can be folded to fit in your pocket. These cards eliminate flipping through the manual when you need information.

The cards give you organized summaries of Basic language and syntax; error messages; special keys; graphics, color and music codes; ASCII tables; memory map; useful memory locations and system routines; I/O device codes; screen layout tables; using sprites on the C-64; and more.

They are organized for quick reference and provide complete information at a glance. Each set of cards costs $5.95.

Check Reader Service number 427.

Make the Connection

The Auto-Print Microconnection, a modem for the Commodore 64 and the VIC-20, features both an autodial and autoanswer capability. It also has a built-in Centronics compatible parallel printer port.

The combination modem and printer interface plugs directly into the computer without the need for additional interface devices. Telecommunications software is included in the user's manual.

The printer port lets you connect conventional parallel printers such as the Epson MX-100, Star Gemini 10X, Tally and Okidata 82A to the back of the modem. With the modem connected to the phone line, the printer will simultaneously provide hard copy of whatever appears on your screen.

The unit measures 5″×6″×2″ and weighs two pounds. It costs $149.95. The Microperipheral Corporation, 2565 152nd Ave. N.E., Redmond, WA 98052.

Check Reader Service number 428.

ELECTRA GUARD

Protect Your System

Computer Power Solutions, Inc. (8800 49th Street North, Suite 203, Pinellas Park, FL 33565) has added a new model to its line of surge suppressors for ac power lines.

Electra-Guard System 2 is a solid-state clamping device designed to protect your Commodore system. It eliminates undetected submicrosecond overvoltage transients from electrical circuits. It expands a standard duplex (two outlet) power receptacle to provide six outlets. It is available for $49.95.

Check Reader Service number 441.

Need Guidance?

Quick Reference Guides for the Commodore 64 and the VIC-20 are available from John Wiley & Sons, Inc. (605 Third Avenue, New York, NY 10158).

The guides are designed to give you instant access to your micro's myriad programming symbols, statements, commands and controls. The guides list and define: Basic statements; system controls; input/output processing statements; memory statements; error messages; video and graphics controls; basic functions; and arithmetic operations symbols.

Each guide is 6″×12″, opening to four panels. They cost $2.95 each.

Check Reader Service number 435.

Take It with You

Molded carrying cases for the Commodore 64 and the VIC-20 are available from Southern Case, Inc. (2315 Laurelbrook St., PO Box 28147, Raleigh, NC 27611).

The TravelMaster TCC-2360 is designed to store and transport the Commodore 64 keyboard and disk drive. The TCV-2360 will hold the VIC-20 system, including the VIC-20 keyboard, cassette recorder, power pack unit, four cassette cartridges and two joysticks.

The cases have luggage-style handles and locking latches. They are made of polyethelene with high density die cut foam interiors. They are available for $79.95 each.

Check Reader Service number 432.

In Need of Security?

Jance Associates, Inc. (PO Box 234, East Texas, PA 18046), has released the Jance Computer Controlled Home Security/Control System.

The system can be operated by a Commodore 64 or a VIC-20. A software program on disk or cassette enables you to adapt the security/control system to fit your home and individual life-style. An add-on home control feature allows real time control of your electrical appliances.

The system kit is designed for do-it-yourself installation. The system features: hard wire perimeter protection; outside and inside alarms; magnetic switches on doors and windows; a panic button; window warning decals; and more.

The system also includes a computer interface cartridge, 200 feet of wire and a 12 volt dc power supply. It is available for $195.

Check Reader Service number 426.

AT LAST! BOOKS THAT TELL ALL!

Commodore 64: The Inside View and **Vic 20: The Inside View** are indespensible tools for anyone developing machine language programs. Written by Microcomputer Consultant Bruce Atkins, these books unveil the technical inner workings of both computers. Included in each volume is:

- a hardware/firmware overview
- details of the operating system kernal and Basic interpreter
- details of bugs and documentation irregularities
- complete disk drive hardware/firmware documentation
- six programs: 1)machine language monitor; 2) disassembler; 3) mini-assembler; 4) disk copy; 5) disk sector dump; 6) disk sector patch

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MicroBase written by aliens

ARFON DENIES UFO INVOLVEMENT

Lafayette,LA--Officials at Arfon Microelectronics today denied connections between their program MicroBase and recently reported UFO landings in the surrounding Atchafalaya Basin. In a daring midnight raid, Lafayette police apprehended Patrick Doyle, vice-president of the company, and several co-workers, as they tried vainly to escape in their pirogue. The police report alleges that the suspects were seen accepting computer programs, thought to be MicroBase, from a reportedly alien vehicle. Doyle released the following statement on Monday morning:

"I would like to reply to the allegations that our program MicroBase was written by aliens. I will concede that MicroBase is out of this world, with its speed, simplicity, and versatility, but it most certainly is not the product of little green men.

"For the record, let me state that MicroBase was written by a human being like you or me, who was concerned about the lack of quality personal data bases for the VIC 20 and Commodore 64. So he came up with MicroBase, the first data base to run interchangeably on the VIC and 64. MicroBase has all the features of the bigger data bases: user-configurability, sort capability, and seven different search parameters. It allows up to 12 fields per record, up to 80 characters per field, and up to 196 characters per record. And it's memory-resident, so it's faster than disk or tape-resident data bases.

"We can only speculate that the UFO rumors were started because of MicroBase's unearthly price--only $29.95 for tape and $34.95 for disk."

When asked just what he and the Arfon staff were doing in the middle of a swamp at midnight with a Commodore 64 and an undisclosed number of MicroBase programs, Doyle replied, "Cataloging the alligators, of course."

For more information about MicroBase and other Arfon products, call (318) 988-2489 or write Arfon Micro, 111 Rena Drive, Lafayette, LA 70503. Dealer inquiries are welcome.

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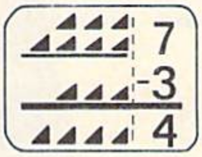
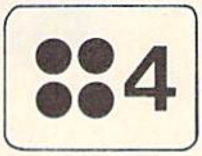
C-64 VIC 20 ATARI

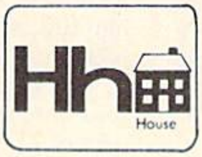
CHILD DEVELOPMENT SERIES



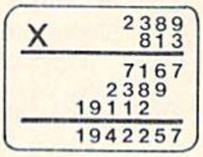
ADD/SUB — $16.95
Displays single or multiple digits with or without pictures, borrows, carries, scoring, and feedback.



NUMER-BECi — $16.95
Number recognition, object counting, object grouping, and number/size/shape discrimination.



ALPHA-BECi — $16.95
Twenty-six screens with letters/pictures/labels 'built' on the screen. (VIC-20 only)



MULT-BECi — $16.95
Multiplication program with up to four digits in multiplicand and three digits in multiplier.

All programs feature numerals and letters in extra large format on the screen and are available on cassette tapes from your dealer or directly from BECi.

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Software RUNdown

Compiled by Shawn Laflamme

vadeboncoeur

Music and Sound Effects

Electronic Lab Industries (100 West 22nd St., PO Box 7167, Baltimore, MD 21218) has released three music and sound effects synthesis packages for the Commodore 64.

With Note Pro I and II, you can create and play music and sound effects on a treble clef musical staff. Note Pro I offers one measure of treble clef per screen.

With Note Pro II, you can enter or edit an eight measure section of music on each screen using a five line musical staff. You can repeat sections of music, switch their order of occurrence and play music backwards. Note Pro Bridge allows the expert programmer and the beginner to add music and sound effects to their entertainment or educational programs.

All three packages include documentation, sample compositions and tone settings. Note Pro I and Note Pro Bridge cost $24.95 on tape and $27.95 on disk. Note Pro II costs $46.95 on tape and $49.95 on disk.

Check Reader Service number 412.

64K
TIMEWORKS
Personal Computer Software
Spellbound
An Educational Spelling Game with Arcade Action
B
E
D
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N

Bee a Better Speller

Spellbound, from Timeworks, Inc. (PO Box 321, Deerfield, IL 60015), is an educational spelling game for the Commodore 64.

Using a joystick, the child guides a bee around the screen and strings the letters of a selected word in proper order. But if he strings the wrong letter or crosses his own path, the bee explodes and he must start again.

There are ten skill levels for children from age six to 18. It is available on disk for $24.95.

Check Reader Service number 409.

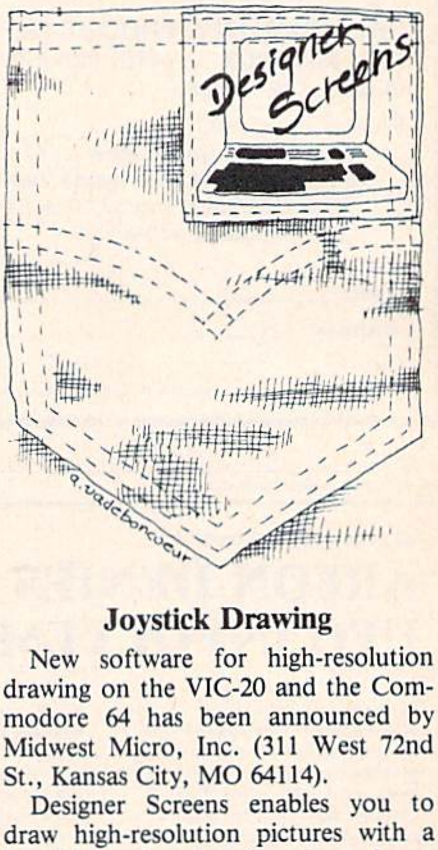
Add a Keypad To Your C-64

The Numeric Keypad, from Cyberia, Inc. (PO Box 784, Ames, IA 50010), is a utility program that converts part of the Commodore 64 keyboard into a keypad for rapid data entry.

You can chain the Numeric Keypad program to most application programs, so that each time you run the application program, the keypad function is automatically available. The keypad program can be used for business, word processing, accounting and educational applications.

The program package includes C-64 compatible key-top labels. It is available on disk for $14.95.

Check Reader Service number 411.



Joystick Drawing

New software for high-resolution drawing on the VIC-20 and the Commodore 64 has been announced by Midwest Micro, Inc. (311 West 72nd St., Kansas City, MO 64114).

Designer Screens enables you to draw high-resolution pictures with a joystick, make printed copies and save the pictures on tape or disk.

You can draw single points and narrow, wide, curvy or straight lines. The program has a picture library that you can use as is or modify by joystick drawing.

Versions are available for the C-64, and both the expanded and unexpanded VIC-20. Full features on the VIC-20 require 8K minimum memory expansion. Supports VIC 1515/1525 and popular parallel dot-addressable printers.

Designer Screens requires a joystick; a printer and disk drive are optional. It is available on disk or cassette for $29.95.

Check Reader Service number 403.

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CASSETTE SOFTWARE

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BANK STATEMENT BALANCER	14,95	15,95	16,95	17,95	18,95	
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DEPRECIATION STRAIGHT LINE	14,95	15,95	16,95	17,95	18,95	
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HOME PAYABLES	14,95	NA	NA	NA	NA	
HOME EQUITY EVALUATION	14,95	15,95	16,95	17,95	18,95	
REAL ESTATE INVESTING	15,95	**16,95	17,95	18,95	19,95	
SAVINGS INVESTMENT ANALYSIS	15,95	**16,95	17,95	18,95	19,95	
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DISK FILE CONCEPTS	NA	**24,95	NA	NA	29,95	

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****DISK SUPPORT ($14.95 postage paid)****

This program, written for the VIC-20 and COMMODORE 64, provides a 1K machine language extension which adds twelve new commands to your computer's operating system. Not to be confused with the cumbersome "wedge", DISK SUPPORT offers 12 separate, easy to use, two-keystroke commands which WORK! You can SAVE with *automatic VERIFY*, SAVE-WITH-REPLACE (eliminating Commodore's DOS bug), LOAD, VERIFY, DELETE, and RENAME disk files with just two keystrokes. Also provided are commands which INITIALIZE, FORMAT and VALIDATE a diskette, EXECUTE any program on the diskette, print the ERROR message to the screen, and list the diskette's directory to the screen (formatted for your computer's display) without affecting the contents of the computer's memory; all with only two keystrokes. DISK SUPPORT is compatible with all memory expansion cartridges, the SUPER EXPANDER and PROGRAMMERS' AID cartridges, and Micro Systems Development's VIE-20 and CIE-64 IEEE interface cartridges. DISK SUPPORT is designed to work equally well with both single and dual disk drives and is a MUST for all disk drive users!

*****DISK DUPLICATOR ($14.95 postage paid)*****

DISK DUPLICATOR is a machine language program which provides you (the owner of a 1540, 1541 or 2031 single disk drive) a fast and convenient way to make back-up copies of your precious, irreplaceable diskettes. DISK DUPLICATOR is 100% MACHINE LANGUAGE, 100% FAST, and most importantly, 100% AFFORDABLE! Diskettes are copies verbatim with as few as 4 exchanges (using a COMMODORE 64). Don't let an accident or a mistake catch you without back-up copies of all your diskettes. ORDER "DISK DUPLICATOR" TODAY!

*****DISK RETRIEVER ($9.95 postage paid)*****

If you have ever accidentally "SCRATCHED" a program or a data file from one of your diskettes and wished there were only some way to recover that precious file, DISK RETRIEVER is the program you've been waiting for! DISK RETRIEVER is a 100% machine language program that will "UNSCRATCH" all of your disk files and restore them to their original status. Let DISK RETRIEVER turn back the clock and help you recover your "lost" programs and files!

*** SPECIAL ***

Order all three programs at one time and SAVE $5.00! If you order the three disk utility programs, you need only send a check or money order for $34.95. We will pay postage and handling.

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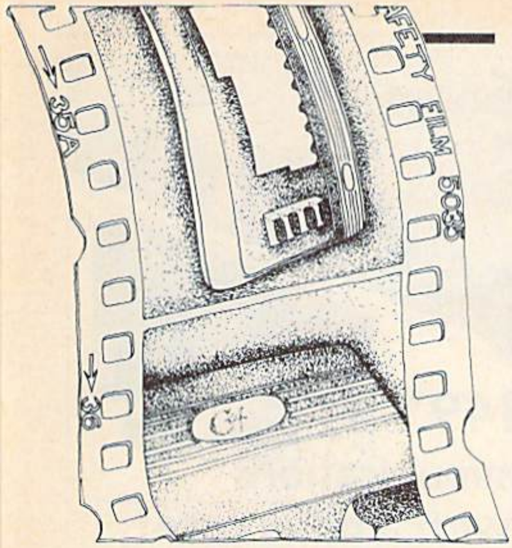


Darkroom Delight

Darkstar, from F/22 Press (PO Box 141, Leonia, NJ 07605) solves problems commonly encountered in the photographic darkroom.

It works with all black-and-white and color materials to provide exposure data for changes in: print density; magnification; lens opening; paper type, emulsion batch and contrast grade; variable contrast filters; neutral density and color-printing filter-pack composition.

It also adjusts color-printing filter-pack composition to correct print color balance, eliminate neutral density and compensate for color paper emulsion changes. It provides processing time compensation for black-and-white films to virtually eliminate the need for temperature control.

Darkstar is available on cassette for the Commodore 64. It costs $49.95.

Check Reader Service number 401.

Micro Music

Music Construction Set is a music composition program and learning tool for the Commodore 64. It lets experienced musicians and beginners compose and play their own music.

The program lets you manipulate an on-screen "hand" with a joystick, keyboard or touch pad to position notes, rests, sharps, flats, clef signs and other musical symbols on a formatted staff. You can then immediately hear how your composition sounds.

The program includes a library of musical selections—from classical to rock—to help the musical novice begin composing. It is available on disk for $40 from Electronic Arts, 2755 Campus Drive, San Mateo, CA 94403.

Check Reader Service number 410.

CodeWriter

C-64 Code-Breaker

CodeWriter allows users of the Commodore 64 to design unique application programs without knowledge of computer programming.

You use plain English to type the screen layout from and the calculations onto the computer's screen. CodeWriter translates them into computer language code.

Applications that can be developed with CodeWriter include: payables and receivables; sales analysis; customer and personnel files; mailing lists; invoicing; inventory and production tracking; order entry and many other similar business uses.

CodeWriter is available on disk for $99 from Dynatech MicroSoftware, Inc., 7847 N. Caldwell Ave., Niles, IL 60648.

Check Reader Service number 413.

64 Sprites on Your Screen

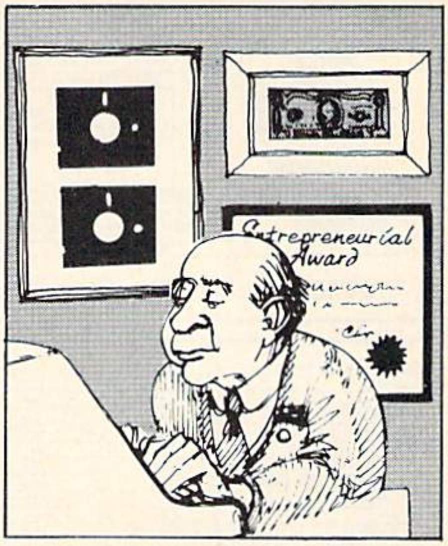
Sprite-64, from Crosstech (2133 N. Fremont, Chicago, IL 60614), is a graphics utility that lets you have 64 sprites on the screen at the same time.

The Commodore 64 video processor chip (VIC-II) is capable of supporting eight sprites at a time. Sprite-64 divides the screen into eight areas referred to as "zones."

Sprite-64 automatically adds a sprite command to Basic. It supports advanced features offered by sprites including: multicolored sprites; X and Y expansion; sprite/sprite and sprite/background collision detection; and background/sprite priority.

The Sprite-64 package includes a 31-page manual and an assembler vector map. It is available on tape or disk for $49.95.

Check Reader Service number 407.



In the Chips

Creative Software (230 East Caribbean Drive, Sunnyvale, CA 94089) has released In the Chips, a concept-educational program for the VIC-20.

In the Chips tests the entrepreneurial ability of one or two players in the development and operation of game software companies. Each company owner starts with $100,000 to finance company operations.

The object of the game is to use your capital in the most efficient way in order to exceed your competitor's profits. You must make decisions regarding product development, inventory, pricing and advertising.

In the Chips requires a joystick and is available on cartridge for $29.95.

Check Reader Service number 405.

Terminal Utility Program

Softlaw Corporation (9072 Lyndale Avenue So., Minneapolis, MN 55420) has released the VIP Terminal utility program for the Commodore 64, the first of an interactive library of programs that will cover home and business needs.

The high-resolution screen gives you a choice of four professional displays. In addition to the stock 40 characters-per-line display, the VIP Terminal offers a 64, 80 and a 106 column format display, all with 25 lines per screen. Full control of screen color as well as several character sets are also offered.

The VIP Terminal supports tape and disk I/O and will work with any printer. It costs $49.95.

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Inside Basic

Sim Computer Products, Inc. (1100 East Hector St., Whitemarsh, PA 19428), has released the Inside Basic series, a group of software packages with both the Commodore 64 and VIC-20 versions on the same disk or cassette.

Titles in the series include Form Generator and Quiz Me. Form Generator lets you design any type of form from invoices to labels. It costs $29.95 on cassette and $34.95 on disk. Quiz Me is a testing program that lets you create a quiz for any subject. It costs $19.95 on cassette and $24.95 on disk.

Two other titles in the series are Kentucky Derby and Number Jotto.

Check Reader Service number 414.

Tired of Taxing Tasks?

Tax Command, from Practical Programs, Inc. (PO Box 93104, Milwaukee, WI 53202), is a Federal Income Tax calculation program for the Commodore 64 and the VIC-20.

Tax Command provides a line-by-line method of calculating income tax for federal tax forms, including form 1040. It provides income averaging, Schedule A-itemized deductions (including medical) and capital gains and losses. It contains tax tables for every filing status.

Tax Command does all mathematical calculations automatically; the built-in tax tables calculate your tax refund or payment. It costs $24.95.

Check Reader Service number 406.

Become a Micro Artist

Graphics Designer 64 lets you design hi-res or lo-res graphics. You can use it for architectural design, engineering graphics, graphic arts, artistic expression and more.

The Graphics Designer 64 editor lets you interactively create your picture. The editor is completely menu driven. No programming is necessary. You can edit a picture from the keyboard, with a joystick or a suitable light pen.

You can draw lines, boxes, circles, ovals and triangles, and then fill them in. Text and captions can also be added. When you're finished, you can save your pictures on disk.

The slide show feature lets you combine pictures for later display. You can also obtain hard copy of the hi-res screen on your VC-1515, 1525E, Epson or Gemini printer.

The Graphics Designer 64 is available on disk for the Commodore 64. It costs $34.95. Abacus Software, PO Box 7211, Grand Rapids, MI 49510.

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Meet TED—We'll introduce you to the newest member of the Commodore family. TED (alias Commodore 264 computer) is well-suited for business, home and educational applications, as well as games, and boasts some impressive features.

The C-64 in Space—No, this isn't another arcade-style space adventure; this article depicts a real-life adventure about a professional astronomer who feels at home in the heavens using his C-64. Read how the C-64 assists this noted star-gazer in his search to discover the tenth planet.

REVIEWS . . .

Spreadsheets—Readers will discover that spreadsheets are more than bed coverings; they're useful tools you can use with your Commodore machine. This article will uncover some of the uses, features, terms and expressions connected with spreadsheets.

Touch-Sensitive Input Devices—Two of the more well-known such devices for Commodore systems—the Koala Pad Touch Tablet from Koala Technologies and the Power Pad from Chalk Board, Inc.—will be compared.

COLUMNS . . .

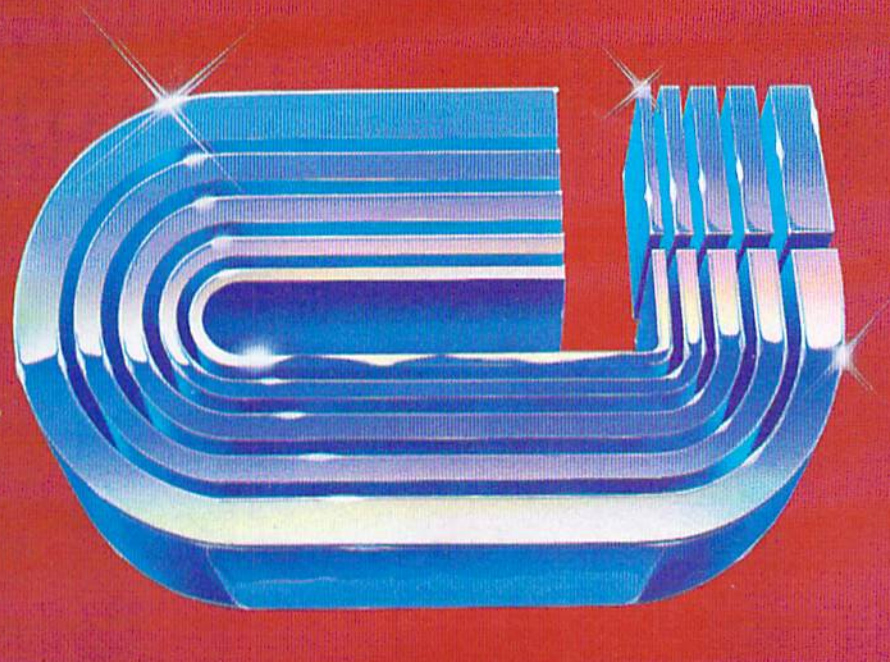
For Gamesters Only—A new game column featuring reviews of the latest game programs for the VIC-20 and Commodore 64 will premiere next month.

Commodore Clinic—Jim Strasma will again be on hand to answer readers' most pressing questions.

Magic—Louis Sander compiles a choice collection of hints and tips to help you get the most out of your computing systems.

Video Casino—This month's game program, entitled "Tunnel Run," depicts an exciting interplanetary chase.

The ULTIMATE Printer Interface?



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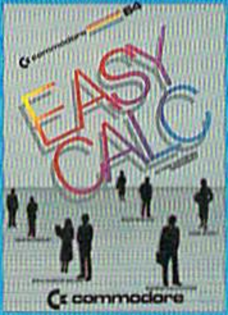
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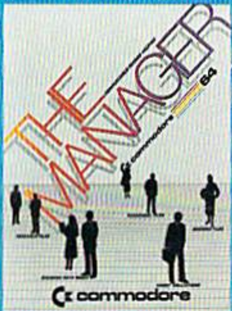
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